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SCIENCE AND TECHNOLOGY

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JPRS-ELS-87-009

18 FEBRUARY 1987

EUROPE/LATIN AMERICA REPORT
SCIENCE AND TECHNOLOGY

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WEST EUROPE/ADVANCED MATERIALS

BRIEFS

FRG ULTRATHIN POLYMER RESEARCH--The BASF, Bayer, and Hoechst companies, the Max Planck Institutes for Polymer Research and Biophysical Chemistry, and the Institute for Organic Chemistry of the University of Mainz have agreed on intensive cooperation within the framework of a joint research project for development of ultrathin polymer or plastic laminates with regular molecular structures. The 5-year program with a total cost of DM37 million is subsidized by the Federal Ministry for Research and Technology. The possibility of longer term cooperation was left open. The polymer layers to be researched are only about 300 angstroms (3 millionths of a millimeter) "thick" and therefore about one thousand times thinner than human hair. As single layer or multilayer systems, depending on developmental results, they are to feature special and, in part, unconventional magnetic, optical, and mechanical properties, and are to be applicable in biologically active systems. They could represent a development impetus for German economy in growth areas such as electronics, materials technology, or medicine. [Text] [Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 440, 26 Sep 86 p 8] 8617/12951

CSO: 3698/Mo36

WEST EUROPE/AEROSPACE

SPOT SATELLITE OPERATIONS, PLANS REPORTED

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 441,
17 Oct 86 pp 11-12

[Text] The French Government had already decided upon its own earth observation program in February 1978. As a result, a satellite and its entire infrastructure were designed and produced through the National Center for Space Studies (CNES) together with Belgium and Sweden. The SPOT-IMAGE company (SPOT = satellite for earth observation) of Toulouse is engaged in worldwide distribution of images. With the help of the ARIANE I launch vehicle the first observation satellite, SPOT 1, was placed in orbit from the French Kourou space station in French Guyana on 21 February 1986. It should be followed by SPOT 2 in 1988 and Spot 3 and 4 from 1990 onwards. The lifespan of these satellites should be gradually extended from 4 to 5 years.

SPOT is located in a solar-synchronized polar orbit at an altitude of 822 km. Large portions of the earth's surface can be captured in a single photograph; the resolution of the images ranges from 10 to 20 m. The satellite's position enables it to take pictures of certain views as often as desired, which is a great advantage, for example, in research on ripening processes in agriculture. With 14 and 5/26 revolutions per day, SPOT is capable of photographing the entire earth's surface in only 26 days. The bulk of information is relayed to the two most important receiving stations, one in France (Issus-Aussagel near Toulouse) and the other in Sweden (Kiruna). Additional receiving stations are being installed in Canada, Bangladesh, Brazil, India, China, and Pakistan.

The images transmitted to earth by SPOT are stored and can be retrieved on demand. The novelty lies in the fact that images may be taken to order, that is, the customer can state which view and what type of picture he wants. In the case of black-and-white photographs, the resolution is 10 m (on this scale, a semitrailer truck appears as a dot) and 20 m for three-color pictures. Moreover, in the event of poor weather, the satellite can "look obliquely and laterally through a system of reflecting mirrors; thus, poor photographs are automatically rectified.

In the SPOT-IMAGE catalog--a database of all available images--information on the pictures entered into all receiving stations is updated continuously and archived in a comprehensible manner. Since the catalog is fully automated, the information can be called up by users at any time. Interested parties in the FRG may obtain SPOT information from the German Research and Experimental Institute for Aeronautics and Astronautics (DFVLR) in Oberpfaffenhofen.

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CSO: 3698/M058

WEST EUROPE/AEROSPACE

AEROSPATIALE STRATEGY OF INTERNATIONAL COOPERATION

Paris LE NOUVEL ECONOMISTE in French 29 Aug 86 pp 32-37

[Article by Jean-Francois Jacquier: "Aerospatiale: The Giant Is Too Small"]

[Text] Free Choice Cooperation

Cooperation, for aeronautics industry manufacturers, consists of joining together to design a product or family of products which they would not have the means to do individually. It may involve aircraft, helicopters, armaments or spacecraft programs. The partners share risks: that is, the expenses for research, development, and industrialization of a project. Each at their level of participation, occasionally with the assistance of the government, they share design tasks while avoiding duplication of research. They also share production, by distributing the work as a function of ability, and contributions to financing; commercialization, by bringing together, for example, their sales forces; profits, which are used to reimburse the financing and to redistribute the surplus to manufacturers according to the risk taken.

Confined to the domestic market, Aerospatiale has taken off along with its European partners. Ariane and the Airbus demonstrate that, despite difficulties, cooperation is not an empty word. The Farnborough Airshow, which opens its doors Monday, will be the golden opportunity for its revival.

Who will construct the next generation long-haul Airbus? France or West Germany? Aerospatiale or Messerschmitt-Bolkow-Blohm (MBB)? Toulouse or Munich? On the eve of the opening, Monday, 1 September, of the Farnborough (English) Airshow, speculation on the subject is rampant. Will the professor be surpassed by the student? This is the inherent risk in cooperation, this sharing of risks, tasks, profits, and losses, as practiced in the European aeronautic industry. Cooperation: even a company like Aerospatiale, which has sales of 25 billion francs and supports a large portion of French high technology activities, especially with regard to defense, does not have the choice. "Cooperation--it is better that it be done with us rather than against us," declared Mr Henri Martre, 58-year-old president of Aerospatiale since 1983. Within the French company, which employs 35,000, more than half of the activity (52 percent) now comes from cooperation. This proves that industrial Europe, at least in certain areas, is not utopia.

Two out of five of Aerospatiale's products are already totally produced in cooperation: the construction of civilian aircraft and space sector. The undisputed stars of civil aeronautics, the Airbuses are constructed in cooperation with Germany (MBB), Great Britain (British Aerospace), and Spain (Casa). All versions considered, more than 500 have been ordered. This is the first time in the history of Europe that a civilian aircraft program has achieved such a level. At Aerospatiale, it provides work for 7,000 of the 13,000 staff of the aircraft division, directed by Mr Jacques Plenier. With the small ATR (Regional Transport Aircraft) initiated in 1981 with Aeritalia, the division is operating at 70 percent because of cooperation. In the space sector (Ariane shuttle and TDF, TV, SAT, Eutelsat, Arabsat satellites), cooperation is the rule and it takes different forms, depending on the different programs. They are also much larger. Ariane, for example, involves manufacturers in 11 countries. However, the partners found most often, in decreasing order of importance, are MBB, British Aerospace, Marconi, and occasionally Americans, such as Ford Aerospace for Arabsat. Two other specialties, the manufacture of tactical missiles and helicopters, have given rise to cooperation agreements. The pivot of the missile activity is the cooperation with MBB. It generates 52 percent of the activity of this sector and involves the Hot and Milan anti-tank missiles (185,000 sold in 30 countries) and the Roland air-ground missiles, 500 of which were purchased by Spain and 4,000 by West Germany.

Stamp

In contrast, there is little cooperation in the helicopter division (17 percent of the activity), directed by Mr Michel Thomas. With the exception of the Gazelle, an antitank helicopter produced with Westland (Great Britain), the rest of the line (Super Puma, Dauphin, Ecureuil, Lama) carries only the stamp of Aerospatiale. The same is true for the Epsilon training aircraft, the AS 30 laser air-ground missiles, the AS 15 TT antiship missile, the C 22 target drone and the famous Exocet, 2,500 of which were sold in 27 countries, which proved itself in the Falklands War, then in the Gulf War.

The only specialty totally excluded from cooperation is ballistics. That is, nuclear warheads of the strike force which are forbidden for export: The Albion plain's S3 missiles, nuclear submarines' M4 missiles, the army's Pluton, and the new ASMP (air-ground medium range) which already equip the Mirage 4 P.

At the beginning, the fate of Aerospatiale was linked to that of cooperation programs. Created in 1970, after a long series of mergers and nationalizations, the company took over programs initiated in the 1960's by Sud-Aviation, Nord-Aviation, and Serb, which it inherited. It involved the bi-turboprop Transall military cargo plane, Gazelle, Puma, and Lynx helicopters, the Hot, Milan, and Roland missiles, and the supersonic Concorde.

In Europe, the idea of cooperation began to grow after World War II. In a report dated 1945 and addressed to Mr Charles Tillon, the minister of the Air Force, the chief engineer, Henri Ziegler wrote: "No European country, especially France, has sufficient economic and financial worth to compete with the two superpowers. The future of our aeronautics industry thus lies in cooperation." The chairman of Aerospatiale, Mr Ziegler, gave substance to the Airbus project in 1970.

Since then, nothing has changed. With his engineering abilities and experience which has allowed him to consider all the implications of the large programs, especially as the head of the general delegation for armaments, Mr Martre has taken the torch of cooperation from the hands of his predecessor, General Jacques Mitterrand, brother of the president of France. Competition and money are always stimuli to cooperation. "If, for a given program, I do not have the necessary resources, I must find partners. Cooperation has no meaning unless it allows several to achieve what one alone cannot achieve," confirmed Mr Martre. The cost of launching the newest product in the Airbus line, the small 150-passenger A 320 which should enter into commercial service in 1988, is estimated to be 2.5 billion dollars. The launching costs of the long-haul A 330 and A 340, if official approval is given, will be more than 3 billion dollars. For the three aircraft, this adds up to more than 33 billion francs, which is equivalent to the sales of Aerospatiale in a good year. France alone would never have been able to afford the luxury of developing a complete family of aircraft, nor would any other European country. Without European partners, after the failure of the Caravelle, 280 of which were sold, and which did not have any successors, and after the ruinously expensive experience of the Concorde, it would probably have been necessary to eliminate the aircraft division of Aerospatiale as well as the French civil aeronautics industry, or at least to give up on developing other new sectors, such as space. If Europe decides to finance the Ariane 5-Hermes-Columbus group (the new launcher, the shuttle and the orbital station), its annual expenditures for space will double, going from 1 to 2 billion ECU.

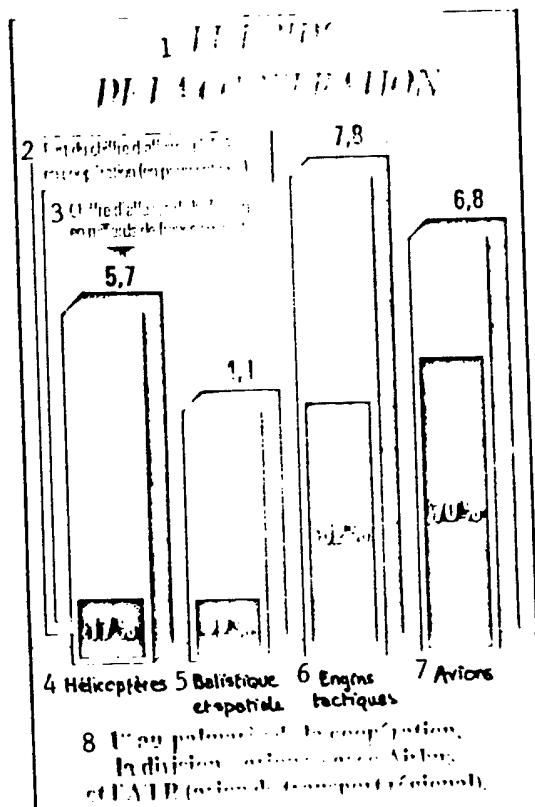
The sharing of costs is not the only reason for cooperation. The power of competing American companies also encourages reorganization. Aerospatiale is worth perhaps twice as much as Dassault, but only one-fourth as much as Boeing (see following table). And, in the United States, there are five companies the size of Boeing in the sector! It is futile to want to compete with these giants in an isolated fashion. The partnership of the three large Europeans (Aerospatiale, MBB, and British Aerospace) with Casa of Spain does not suffice to even achieve the level of McDonnell Douglas.

Aerospatiale Confronted With the American Steamroller

Companies	Sales in billions [trillions] of francs	Staff in thousands
United Technologies (United States)	118.7	184
Boeing (United States)	103	104
McDonnell Douglas (United States)	86.7	97
Rockwell (United States)	86.1	123
Hughes (United States)	46.8	80
British Aerospace (Great Britain)	28.7	75.5
Aerospatiale (France)	24.6	35
MBB (West Germany)	18.9	35
Casa (Spain)	2.3	9
Aerospatiale + MBB + British Aerospace + Casa	74.5	156

Leader of European aeronautics along with British Aerospace, Aerospatiale is flattened by its American competitors, which are worth an average of four times more. Partnership with other European groups is the only means of countering this imbalance.

In the export markets, in order to not be flattened by the American steam-roller, the only possible defense for the Europeans thus consists of entering into partnerships and pooling their own markets for extending their production and eventually offering less expensive equipment to Third World countries. The domestic markets are not sufficient to support Aerospatiale. Only exports can increase its growth. In 10 years the proportion of these exports in the sales figures has gone from 30 to 70 percent (see figure). On the other hand, American companies benefit from large civilian as well as military domestic markets to absorb their products before they are exported. Half of the worldwide market for commercial aircraft, excluding Eastern countries, is in the United States, and it is necessary to show one's credentials before entering there. Another example is the disproportionate military market: whereas Sikorsky will deliver 840 Black Hawks to the American Army, the French Government will purchase three Super Pumas from Aerospatiale. In contrast to the American helicopter, the Super Puma was entirely developed with equity capital.



Figure

Key:

1. The price of cooperation
2. Portion of sales achieved in cooperation (in percent)
3. Sales of division in billions of 1986 francs
4. Helicopters
5. Ballistics and space sector
6. Tactical missiles
7. Aircraft
8. Number 1 in the area of cooperation, the aircraft division with the Airbus and the ATR (Regional Transport Aircraft)

Today, cooperation is spoken of by everyone, even the Americans. Recently, the officials of Boeing, who, however, have little inclination to share, launched an appeal for international cooperation. McDonnell Douglas has initiated negotiations with Airbus Industrie. At the request of the FINANCIAL TIMES, Mr Martre has prepared a conference on the theme of cooperation for the Farnborough Airshow. The subject is now in fashion again because large programs are being compared. This is a date with the future which Aerospatiale must not miss. What are its chances?

Despite the uncertainty which still surrounds the launching of the long-haul Airbuses, the aircraft division is the best prepared. Its two families, ATR and Airbus, are on the agenda for the year 2000. "On the condition, however, that they are well managed," specified Mr Michot.

Trouble

It will be more difficult to renew the helicopter lines. To retain its place as the largest worldwide exporter, Aerospatiale cannot allow itself to make the slightest false step. However, the trials and tribulations of the French-German helicopter have been alarming. Inasmuch as a failure would risk upsetting another project, that of the NH-90, a tactical transport craft intended for NATO forces, 700 units are to be manufactured in cooperation with France, Germany, Italy, the Netherlands, and Great Britain. The purchase this year of the British manufacturer Westland by the American Sikorsky company seriously complicates things. The latter would be happy to create trouble among the Europeans to make it easier to swallow up its competition, the Black Hawk, which it promised to subcontract to Westland. Suddenly, the British Army might prefer the NH-90.... Thus, for Aerospatiale, the NH-90 is vital. It must take over for the Super Puma.

The tactical equipment sector is not any better off. The projects under study have experienced delays in planning and the equipment currently in production has lost speed because of saturation of the market. Certain techniques, especially armoring, have also developed more rapidly. The successors to the Milan and Hot antitank missiles, named AC3G (third-generation antitank missiles), have been the subject of negotiations for 7 years with France, Germany and Great Britain.

Aerospatiale and MBB are sharing the profits of the Hot and Milan missiles. In the future, it will be necessary to share them with British Aerospace. However, ANS, the successor to the Exocet, the vulnerability of which will be rather large within 10 years, will become a French-German program. It is a supersonic antimissile, and the rocket uses a ram-jet engine for propulsion. This is a technique which Aerospatiale is the only one in the world to have mastered. However, the approval of governments is being delayed. It is also being delayed for Aster, the replacement for Roland, and it is not yet known whether it will be manufactured jointly. According to Mr Michot, "to be sure, it is necessary to launch the AC3G and Aster within 2 years." The technological feats of Aerospatiale are not sufficient to guarantee the renovation of its business premises. To a large extent, its future depends on the uncertainties of cooperation.

Concentration

By relying on the expertise of each partner, cooperation also allows a concentration of effort which would otherwise be impossible. The aeronautics and space industries, since they are advanced technologies, require impressive "task forces." Therefore, in the research bureaus of its aircraft division, Aerospatiale employs 1,700, of which 1,000 are engineers and high-level technicians and 500 are designers. The manufacturers thus share the tasks. In the Airbus, for example, Aerospatiale, which was the main contractor, was also responsible for designing of the aircraft's nose, cockpit, and systems.

British Aerospace was responsible for the wings, MBB for the airframe and the vertical stabilizer, and Casa for the rear ailerons. "For satellites," explained Mr Jean-Charles Poggi, director of the ballistics and space division of Aerospatiale, "in the same way we have decided to specialize in certain key technologies, which will allow us to be the main contractor as well as one of the partners."

The final advantage of cooperation is that it facilitates financing of sales. They are becoming more and more important. Thus, they are increasingly higher and rely on extremely complex techniques. This is the strength of partnership: it is in part due to the guarantees provided by each of the cooperating manufacturers that the Airbus "contract of the century" with Pan Am (75 firm orders and options for 30 billion francs) was achieved.

"Cooperation is a necessity and also sometimes a burden," emphasized Mr Yves Michot, program director at Aerospatiale. The first difficult situation was to decide to cooperate on a program and be in competition for all the others. In such a case, the partners are too mistrustful. The proof is that after the purchase of Westland by Sikorsky, president Martre decided to withdraw, at least temporarily, his confidence in the British and to move to Marseille his part of the manufacturing of the Gazelle.

Another difficulty is agreeing on a joint program. That is, on a product having not only the same general characteristics, but also the same equipment and compatible delivery timetables. "This is why the Airbus A 320 will arrive on the market with a delay of 2 years," stated Mr Alain Bruneau, an official of the Airbus program at Aerospatiale. The explanation is that the Germans were evasive because their domestic airline, Lufthansa, would have preferred to have long-haul aircraft available first.

However, the most significant example in this regard is that of the French-German helicopter. It has been more than 10 years since France and West Germany planned to jointly construct this machine, which was intended to stop the advance of Soviet tanks. After several ups and downs, on 29 May 1984, the ministers for defense of both countries, Mr Charles Hernu and Mr Manfred Worner, signed a development contract concerning the precise definition as well as the basic helicopter which could give rise to three different versions: one for the Germans and two for the French with, as a bonus, cost overruns of 58 percent. "The difficulties of harmonization in this type of program," stated Mr Martre, "frequently arise from the incompatibility of the budgetary timetables or a disagreement between chiefs of staff."

In the case of the French-German helicopter, it is the military that is causing the problem. The Germans want 212 heavy antitank aircraft (PAH2), equipped with an American guidance system mounted in the nose and a dual cockpit. The French need 75 flight support-protection (HAP) helicopters and 140 light anti-tank (HAC3G) helicopters which are more high powered than the German vision. They also want a European guidance system, which remains to be developed, and a cockpit where two of the crew members sit side by side. These two designs are obviously mutually exclusive. Each side is holding firm and the affair is being drawn out. "If this is going to continue, it will be necessary to pay the consequences," confirmed Mr Martre.

A third criticism often made of cooperation is that it results in loss of expertise. This is the opposite of technology transfer. Thus, even if the officials of Aerospatiale categorically deny that the Germans have the means to assemble the future long-haul A330 and A340, the MBB engineers have incontestably made up a portion of their technological delay with the Airbus. Because of the distribution of tasks, on the other hand, Aerospatiale today has stopped operating in the area of wings. The responsibility for this technique, which is essential for the success of an aircraft, is now the responsibility of the British for the Airbus and of the Italians for the ATR. This type of sacrifice imposed by cooperation is unavoidable, unless we could imagine an extravagant Meccano system [translator's note: a meccano set is a European child's toy, consisting of a set of miniature parts from which engineering models can be made (e.g., airplanes, windmills, oil derricks)] operating.

Threshold

The choice of programs, the definition of their characteristics, and technology transfers and losses of competence, finally all argue in favor of a reduced number of participants. With such logic, one rapidly reaches the absurd conclusion that it is better not to cooperate at all. In fact, the model considered as exemplary is Airbus Industrie: four countries, four manufacturers. In Mr Bruneau's opinion, "It is certainly the upper threshold of good partnership for developing a family of products." Beyond that, one risks a free choice of programs which is difficult to manage. Thus, the primary reason for cooperation is to alloy savings to be made.

The Accounting Office appears to doubt this. In 1985, in the report to the president of France, it noted "a loss of financial autonomy of Aerospatiale to the benefit of the Airbus industry" which was determined to be harmful to healthy management. How is it possible to know if, in the end, a joint program will be profitable? How can we know if the final product will be less expensive if it had been manufactured by a single manufacturer? The exercise is dangerous and the comparisons are difficult because of the lack of experience. This is, however, an exception: the TOW antitank missile of the American company Hughes and the Hot, jointly manufactured by MBB and Aerospatiale. These two weapons are quite similar. In 1977, Hughes offered 7,500 TOW missiles to the British Army for £25 billion. The Hot missiles cost almost twice as much!

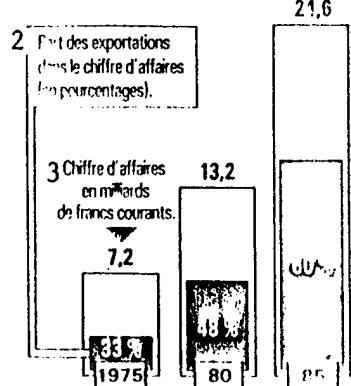
These uncertainties are added to the worries caused by the ballistics division. Not only have the credits of the strike force been decreased in a disguised manner to the benefit of the Dassault Mirage 2000, but it also has no new large program. The next planning law, currently in preparation, should soon compensate for this loss by authorizing the manufacture of a new nuclear component, the mobile SX missile. However, the army is disputing the equipment credits, which, however, have undergone a large increase, and Mr Martre does not want to count his eggs before they hatch. "If this program is not launched," he advised, "my responsibility as a manufacturer requires me to disperse the research teams which are working in this sector. The consequence will be a serious loss of competence for Aerospatiale as well as for the country." The risks are the same in the space sector if Germany does not decide to support and finance Hermes. The last Ariane did nothing to improve the situation.

For the next 10 years, the margin of maneuver of the president of the French company is quite limited. An Ariegeois, Mr Martre has the reputation of being a man who has his feet on the ground and knows how to combine prudence and boldness from his experience in the Ministry of Defense, and he retains a good knowledge of the markets. He also has the advantage of being known as a boss who knows how to solve a problem. He has already succeeded in bringing peace to a company which was still affected by the trauma of mergers and the Concorde, and which has always suffered from the Dassault combat aircraft monopoly. To succeed, it must be careful. The aeronautics industry is particularly sensitive to changing circumstances. The balance sheets of Aerospatiale reflect this quite well. The low number of orders during 1982-1983 are now having repercussions. Sales are stagnating and the decrease in budget expenses has resulted in surplus production capacity. This is especially true of the aircraft division. It is equipped to produce eight aircraft per month, although only two and one-half are being produced. This underactivity and the necessity of achieving gains in productivity have required a reduction in staff of 500 people per year for the past 3 years. The workers, slightly more than 8,000 out of the 35,000 employed, are the most affected. And the tendency will only become more accentuated. Constrained by profound changes, the modern aeronautics industry will sell more and more research hours and fewer and fewer factory hours. Aerospatiale has not escaped the rule: metalworkers are leaving and computer specialists are becoming more powerful.

Mr Martre is aware of all this. In 2 years, he has succeeded in changing the financial situation in a spectacular fashion: from 357 million francs of deficit in 1983, the company has gone to 454 million francs in profits last year. The indebtedness has been reduced, and the capacity for self-financing improved, and the research expenditure brought to 6.8 billion francs, or 28 percent of sales. He has also demonstrated a new commercial aggressivity, which is manifested by an increase of 73 percent in orders for the year 1985 (see figure).

Pincers The fall of the dollar and the fluctuations in oil prices have modified the strategies and caused a fallback for the European, American, and Southeast Asian vendors. There are areas where client countries are judged to be solvent or where they will be in the future. In parallel, we have witnessed the emergence of new aeronautics industries in developing countries. Already, Brazil,

1 L'INTERVENTION D'AEROSPATIALE



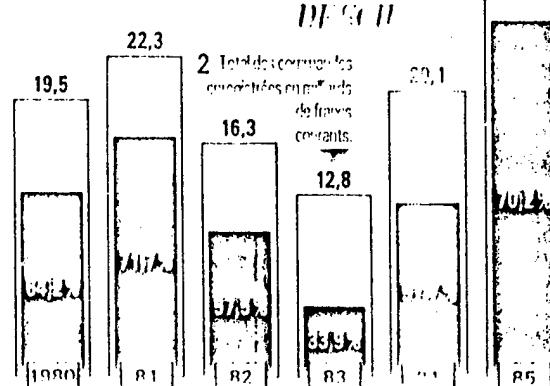
4 En 10 ans, la part des exportations dans l'activité de l'Aérospatiale a presque doublé.

Figure 2.

Key:

1. The Export Breakthrough
2. Proportion of exports in sales (in percent)
3. Sales in billions of 1986 francs
4. In 10 years, the proportion of exports in the activity of Aerospatiale has nearly doubled

1 DISONNANCE DES ORDRES DE 1985



4 Grâce à ses ventes à l'exportation et à l'Airbus, en 1985 les commandes dépassent de 10 milliards de francs le chiffre d'affaires.

Figure 3.

Key:

1. Fluctuations in Orders
2. Total of orders received in billions of 1986 francs
3. Proportion of exports in orders (in percent)
4. Due to its export sales and the Airbus, in 1985 orders exceeded sales by 10 billion francs

India, and Israel have become competitors. Tomorrow, it will be the turn of Egypt and Indonesia. Between these challengers and the powerful Americans, the Europeans and Aerospatiale are caught in a pincer. Cooperating each time it is possible and making allies will be the next challenge for the French company. "In any case, it is the only way we can expand our frontiers," said Mr Martre.

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WEST EUROPE/AEROSPACE

HERMES SEEN AS 'TEST' IN FRG-FRANCE SPACE COLLABORATION

Stuttgart FLUG REVUE in German Dec 86 p 12

[Article by Goetz Wanger: "European Shuttle Alternative--Hermes Orbital Glider--A Matter for Negotiations"; first paragraph is FLUG REVUE introduction]

[Text] A green light for the European space taxi Hermes: after the FRG announced its decision, the tug-of-war for orders began.

The vote of the Federal Government to take part in the Hermes Project is formally valid only for the preparatory phase. Before the end of this year, Bonn will pay DM9 million into the coffers of the ESA [European Space Agency] for this project, and next year it will be another DM23 million. That corresponds to the 30 percent underwritten for the current preliminary clarification study that is to lead to a final decision on the space aircraft in 1987.

In space circles, the long-overdue German decision is called an important step in the direction of the desired European autonomy in space. The Hermes space glider would probably have had no chance of being implemented without the financially solid partners from the FRG. The ESA members had already agreed on the Ariane 5 heavy-load carrier with which Hermes will be transported into space. The goal is the supplying of space stations, just as is now planned for the mid-1990's in the framework of the Columbus Program for which an agreement has likewise been reached. Hermes can take four to six astronauts on board and stow about 4.5 tons of freight in the cargo hold.

The Hermes Project was pushed primarily by the French side. The French space agency CNES had taken upon itself to have the essential specifications worked out in a national design competition between Aerospatiale and Dassault. In this way, not only these two firms but also the subcontractors for avionics, propulsion and structure were able to occupy important key positions long before the current beginning of the actual struggle for industrial contracts in the scope of Europe. The reduced participation from 50 to 45 percent announced by the French side after the German decision has no effect on this.

The German representatives experienced how difficult it will be for the industry of other nations to cut attractive slices out of this French front.

It is thereby less a matter of individual component groups, over which there is substantial clarity, but of insights into the overall system. Ernst Hoegenauer, deputy space chief for MBB-ERNO, has therefore long been calling for a second Hermes integration line in the FRG. With this proposal, he has heretofore encountered deaf ears in France. For him, Hermes is now the key test of German-French cooperation. He gives the example of the Airbus commercial aircraft, which worldwide is stamped as a French product even though the FRG has an equal share in it. "This must stop now," demands Ernst Hoegenauer. As long as a year ago, the French had signaled him: "A German participation of 20 to 25 percent is enough. We do not want more than that." At that time, according to Hoegenauer, they had argued that they did not want for the Germans to have any insights into the system, a demand that the German side is presenting more strongly with the 30 percent that it now has.

In practice, in the view of MBB-ERNO, that should be as follows: of the eight models planned for Hermes--only two are flight units and the rest serve special tests--three are to be assembled in Germany. An identification model, the structural model to be tested by the Industrieanlagen Betriebsgesellschaft GmbH, and every other flight unit are on the wish list. Dr Helmut Ulke, Dornier space chief, also considers it important for German industry to have insight into the overall space glider system. He does not necessarily link this with the demand for system integration on German soil: "What is important is cooperation in system engineering," says Ulke in defining his ideas for a satisfactory solution.

As for the internal national coordination of work packages, Dornier is demanding the same share as MBB, that is, 35 percent of the German share. Ulke: "MBB-ERNO has already received large contracts in the Ariane and Columbus programs, so our demand is certainly not unjustified." So far it has been established only that Dornier is to be responsible for the life-support system and MBB-ERNO for the propulsion system. Dornier is demanding control over the fuel cells but Siemens also wants to work here. All other contracts can be won only within the scope of invitations to bid in all of Europe.

MBB-ERNO complains that the Germans have heretofore been excluded from project management for nonmechanical subsystems, as, for example, in the cases of flight control, communications, data management, power supply, and software. "These five packages are currently all under French control," criticizes Ernst Hoegenauer. Dornier would also like to see itself more involved in the electronics but also in the area of materials for hot structures, materials that are to protect Hermes in its reentry into the earth's atmosphere.

The reason for industry's jockeying for position in the scope of the Hermes program is clear: Here technologies are being applied that will also be of crucial importance in future aircraft. The experts from Dornier and MBB-ERNO have a joint undisputed standpoint in answer to critics who see Hermes as a technologically obsolete concept similar to that of the shuttle: Without the intermediate step of Hermes, in which--with the exception of the propulsion system--the necessary technologies are being developed in Europe for future space transporters, such systems of the next generation as the British HOTOL or the German Saenger cannot be realized.

WEST EUROPE/AEROSPACE

FRG STUDIES AERODYNAMICS, STRUCTURE OF SAENGER SPACEPLANE

Stuttgart FLUG REVUE in German Dec 86 pp 23-25

[Article by Klaus Mueller: "Saenger Project--Europe Plans Two-Stage Shuttle--Return Flight Included"; first paragraph is FLUG REVUE introduction]

[Text] Transport into space has become a critical question in space operations. New and cost-effective systems must be available in 20 years at the latest. With the Saenger project, the FRG is participating in the discussion of a new generation of manned carrier vehicles.

The first glance is deceiving. Only the principle links the Saenger II project that the FRG has proposed to the ESA [European Space Agency] with Eugen Saenger's concept of a two-stage space transporter from the early 1960's: In piggyback transport, the first stage resembling a supersonic jet carries the second stage, which hints at a relationship to the planned European space glider Hermes. Just a vision of the future 20 years ago that was then technologically unfeasible, the Saenger II project could be realized in about 20 years with the materials available today and the know-how that has now been acquired.

The point of departure for the reactivation of the Saenger concept was the fear that, in the foreseeable future, rising transport costs could wreck the budgets of the European space countries. There would then be hardly any financial latitude for the development and building of the payloads. With Saenger II, on which the engineers from Messerschmitt-Boelkow-Blohm (MBB) have again been working intensively since 1984, or with another similarly economical project, transport costs could be reduced to about one-fifth [of the present level]. The precondition, however, would be a policy decision by the European governments to ensure long-term independence from the United States in manned space operations as well.

Undergoing change: the latest configuration of the Saenger Shuttle takes into account aerodynamic findings on hypersonic flight. In the first phase, the airfoils of the two stages are linked so that they act as a single surface [photo not reproduced].

With the development of Saenger II, Europe could kill two birds with one stone, thinks Ernst Hoegenauer, deputy chief of the space operations area of

MBB responsible for the work on the project. For one thing, a flexible transport system of the next generation should be available somewhere around the year 2005. In addition, however, the first stage, which with its air-breathing engine is to be accelerated to Mach 6 and reach an altitude of 30 kilometers, could be developed into a supersonic commercial aircraft, the Airbus of the generation after the next one, if the market were to show a demand for it. At least the technology for it would be the same as for the first stage of the space transporter.

The engineers are still working over the different configurations for the Saenger II system. Thus, they found out only recently that the original concept with low wings in both stages produces aerodynamic problems: Flow processes develop between the two wings that then lead to unacceptable structural stresses at high speeds. The solution: The first stage is designed with high wings and the second retains low wings. The two vehicles are linked in such a way that the two surfaces are one on top of the other and act aerodynamically as a single surface.

Only a Few Days Ground Time Between Two Flights

According to existing calculations, the first stage, which is 50 meters long, is to weigh about 300 tons, 200 of which are fuel. The second stage, which is 25 meters long, would probably weigh 50 tons, excluding payload, of which 35 tons would be fuel and oxydant.

The core of the considerations, however, is the first-stage engine, upon which success or failure depends, which is also the case for the one-stage competing British HOTOL project. By limiting the maximum speed to Mach 6, the designers could get along with a ramjet engine, a technology that is already being achieved today. If, on the other hand, the hardware must to achieve Mach 8 or Mach 10, it would be necessary to use supersonic compression (scramjet), a technology that raises additional problems and thus would be more expensive. Still, Saenger II could take off from any airfield with a runway suitable for jets; a length of 2.6 to 2.8 km is sufficient. This would make unnecessary--another cost-saving element in the calculations--the costly transport of the carrier to the launch base near the equator, which has heretofore been preferred for most launches into space. Nevertheless, the Euro-Shuttle could deliver its payload in any desired orbit, including an equatorial orbit. For the first stage can, with the help of its six ramjet engines with about 400 kN thrust each, maneuver like an aircraft, transport its "rucksack" to any point over the surface of the earth for ignition of its rocket engine, and then return to the base.

The second stage--manned as HORUS, unmanned for payload transport but then, to be sure, not reusable and designated as CARGUS--is to receive a cryogenic rocket engine with about 300 to 500 kN thrust operated with liquid hydrogen as fuel and liquid oxygen as oxydant. It can carry 4 tons of payload into an orbit as high as 400 kilometers or 10 passengers plus 2 tons of freight to a space station, for example. This performance is fully adequate for supplying a space station, for a crew change, or for the repair of a defective satellite but not, of course, for the construction of a large space station. Still, the MBB engineers are counting on a ground time of only a few days between two

flights, whereby there is no need for the costly and time-consuming transport between the landing and departure fields.

Until recently, MBB has taken on the project at its own risk and invested 20,000 man-hours in the research. The Federal Ministry for Research and Technology has now approved DM250,000 for the preliminary phase and has held out the prospect of the first millions to continue the work next year. Some 10 to 12 million accounting units will be needed for development prior to the delivery of the first flight unit in about 20 years; an accounting unit is equal to about \$1. The sum would be distributed over at least 10 years. And, should the ESA decide in favor of Saenger II, it would be raised jointly by the partner countries.

For the present, according to Hoegenauer, it is important to clarify the areas in which technology must still be acquired. As things now stand, that will be necessary in aerodynamics, materials, avionics and propulsion systems. For reentry technology--in view of the high speeds, both stages must be protected against the high temperatures that occur--the necessary know-how will be acquired with Hermes, the European space glider being pushed by the French. For this reason, Hoegenauer also considers a substantial German participation in Hermes to be indispensable, so to speak as a preliminary step for the work on Saenger II. It is still uncertain, however, how far the politicians will follow these ideas.

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WEST EUROPE/BIOTECHNOLOGY

FRENCH PUBLIC R&D FUNDING FOR BIOTECHNOLOGY

Paris BIOFUTUR in French Oct 86 pp 35-39

[Excerpts] Without any question, the United States and Japan are the two main leaders in industrial biotechnologies. Furthermore, contrary to the general belief, public aid is considerable in these nations. In contrast, what is the situation in France? This study tries to answer the question. Do medium-size businesses, which need innovations and therefore research and which can generate jobs, receive enough help?

The following synthesis was put together from numerous documents. First of all, there are the official texts and figures giving national research and development (R&D) spending and the civilian R&D budgets for the United States, Japan and France. Next, in order to learn the exact share of these sums reserved for biotechnologies, the experience and competence of high officials and industrialists have been drawn upon. Finally, a comparison of all these figures made it possible to arrive at the figures shown in the tables (but in no case are they the averages of different figures).

United States

The United States was the first to plunge into the industrial biotechnological adventure. (Footnote 1) (Creation of Cetus in 1971 and Genentech in 1976.) "In order to understand the current situation, one must realize that the public sector has played a prime role, encouraging all interesting lines of development, with the private sector later taking over," emphasizes the summary of one report on the American biotechnological industry by the Department of Scientific and Technical Cooperation of the Ministry of Foreign Trade.

Japan

Japan is the second "giant" in biotechnology. Entering the bioindustrial race after the United States, it has chosen to grant more massive and more open aid to its private sector. This determination bears witness to major biotechnological expansion. It is also perhaps the reason why the designation of areas covered by biotechnology is very often subject to variation, depending on the source. We have therefore endeavored to take into account only the declared biotechnological programs and, from one year to the next, to include only those sums specifically granted to biotechnologies.

France

France, like Europe, while possessing basic research of international quality and fame in numerous branches of biology, has been long in evaluating its results. The transfer of scientific accomplishments from public basic research to the private domain and its exploitation have come about only partially and later than in the United States and Japan.

French Subsidies and Aid

Various measures encouraging research do exist in France and since 1981, specific aid has been given to industrial biotechnologies through the promotional Boom in Biotechnologies program. Except for this program, most government participation in research and development in biotechnology comes in the public research centers and institutes (the CNRS [National Center for Scientific Research], INSERM [National Institute of Health and Medical Research], the INRA [National Agronomic Research Institute], and so on).

Incentives and nonspecific aid to bioindustrial research mainly include the tax-research credit, aid to innovation of ANVAR (National Agency for the Implementation of Research) and co-financed scholarships (CIFRE, the CNRS, FIRTECH, and so on). ANVAR credits, because of their mode of distribution, do not help all enterprises engaging in active, high-performance industrial research. ANVAR has a budget which, compared with other major organizations, remains modest, considering its strategic mission and the scope of its task. The credits it allocates can only complete other measures (conclusions of a report by the CSRT (High Council on Research and Technology).

Table 3 [below] gives the main figures for the French public R&D budgets and the share allocated to biotechnologies, which is low. Public aid for biotechnological research and development in industry mainly come, in France, from the MRT and is granted through the Program To Promote Biotechnologies. Aid given by ANVAR is very little in this field. Public aid for research and development in the bioindustries represents less than 6 percent of the public budget devoted to biotechnologies and under .01 percent of the overall public R&D budget.

1986: Year of Hitches; 1987: Uncertainty

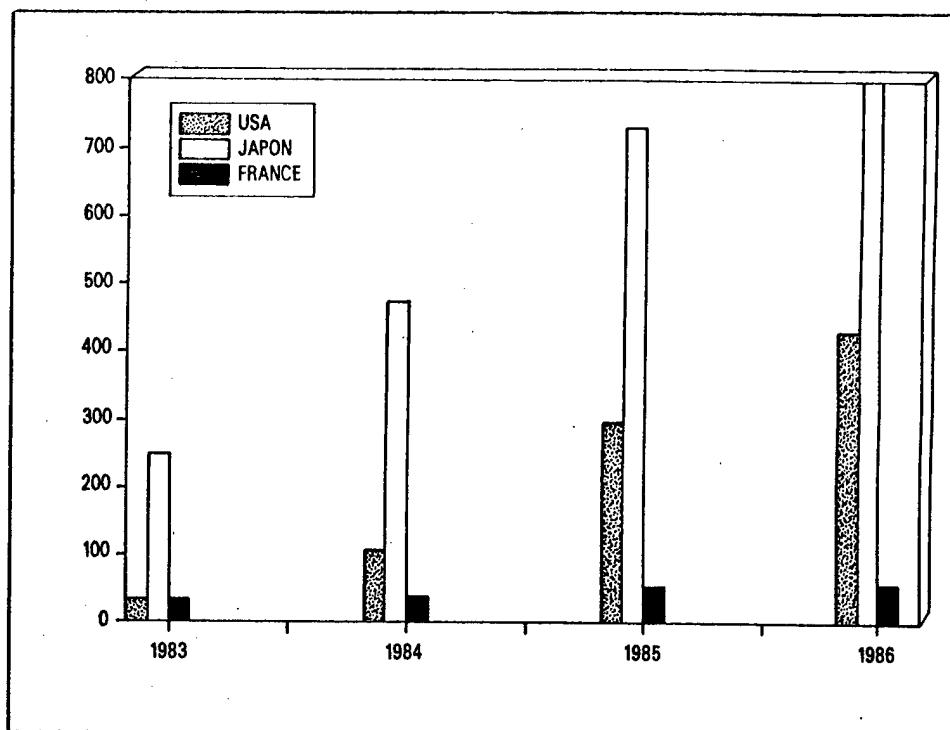
As everyone knows, 1986 was a year of hitches and many complaints were registered in scientific circles stemming from budget cuts.

Following publication of the figures in the civilian research and development budget for 1987, one has reason to fear lest aid to industrial research be almost alone in withstanding the shock of budget restrictions. For 1987, basic research is not reduced, but aid to industrial research is. Only the tax-research credit is maintained (to what extent?). Francois Kourilsky, vice president of the CSRT, expressed his concern over "the decline in the overall French R&D effort" and over the future of the policy to revive industrial research.

Table 3. R&D Budgets in France (Source: Ministry of Research)

<u>Sums in Millions of Francs</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Total public and private R&D budget	74,800	84,800	95,000	104,000	
Public R&D budget	42,636	48,336	54,150	58,240	
Public R&D budget for biotechnologies		680	800	1,000	1,000
Minimal public aid to biotech. R&D of industry		34.5	40	57	50

Table 4. Comparison of Minimal Public Aid to Bioindustries (millions of francs)



Conclusion

This study was made based on a very large number of different sources.

It shows that the United States and Japan provide major financing, both public and private, for research and development in biotechnologies. Public aid granted in the United States and Japan to the biotechnological industry is much higher than that granted in France.

"Despite the stated determination to encourage the development of the French industrial research, the facts show that France's position regarding the overall industrial research effort is very small compared with that of its main Western rivals," one reads in the conclusion of the April 1987 CSRT report. (Footnote 2) ("Government Policy on Industrial Research": remarks by the Industrial Research and Technological Transfer Committee of the High Council on Research and Technology)

Table 4 [above], which enables one to visualize, side by side and on the same scale, the public R&D financing of American, Japanese and French bioindustries, gives one cause for alarm!

While the United States and Japan move ever ahead in supporting their bioindustries, while our European neighbors choose to invest in the sector (yielding profits and jobs), can France deliberately choose to reduce its support for bioindustrial research? (Footnote 3) (In Italy, 4.7 billion French francs over 5 years for biotechnological projects, public and private combined; in the FRG, 1 billion marks, or 3.3 billion French francs over 5 years; in the Netherlands, 30 million florins, or 87 million French francs for biotechnological projects concerning the environment.)

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WEST EUROPE/BIOTECHNOLOGY

BRIEFS

BAYER RESEARCH EXPENDITURES--Research has equal value in the chemical industry with production and marketing, since all products result from intensive research activity. The 140,000 patents acquired at home and abroad are impressive evidence of the efforts in this respect by Bayer AG. Bayer invested DM2.134 billion worldwide in research in 1985 alone, DM1.166 of which was invested by Bayer AG. A structural analysis of sales composition shows that about 40 percent of turnover is reinvested in products that were created as a result of internal research during the last 15 years. Approximately 6,305 employees are working on basic and applied research and development (Bayer's worldwide staff is 12,717 people). Individual commercial branches have their own research facilities which perform an essential research activity. In addition, the main research center is working on future products and processes independently of the commercial branches; for example, in the fields of solar energy, tertiary oil extraction, microelectronics, and bio-and genetic engineering. [Excerpt] [Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 441, 17 Oct 86 pp 13-14] 8622/12951

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WEST EUROPE/COMPUTERS

SIEMENS INTEGRATES PACKET, DIGITAL SWITCHING WITH OPTICAL FIBERS

Munich COMPUTERWOCHE in German 10 Oct 86 p 4

[Article by CW: "Siemens Introduces Glass-Fiber Ring LAN--Integrates Packet Switching and Circuit Switching Into One Network"]

[Text] Munich--With the announcement of an optical fiber-based circuit switching packet/switching ring network (CP ring), Siemens AG, Berlin/Munich, has opened up new vistas in the field of LAN design.

The combination of time division multiple access (TDMA) and token ring makes it possible to integrate packet transmitting and digital communication into one network utilizing hybrid access methods, explained Joerg Eberspaecher of Siemens, Munich, on the occasion of the Third European Conference on Office Systems and Information Management of the CW/CSE in Munich. With this "development on the cutting edge of technology" Siemens has moved a step ahead of IBM's research efforts, since the market leader is working on packet transmitting, nonintegrated data transfer. However, Eberspaecher acknowledged that Philips and some other companies are also active in the development of optical fiber integrated networks.

The basis of the still-experimental CP ring is a glass fiber network whose advantages, according to Eberspaecher, go far beyond the quality of copper cable. The low attenuation of the cable that gives it the ability to bridge distances up to 5 kilometers, a transmission capacity of more than 64 kilobytes per second, and compatibility with the electrical network components commonly used today all counterbalance the high cost of the lightguides.

According to Eberspaecher, an engineer, the integration of both communication methods into one system, a model of which was presented at the conference, would increase the net transmission speed to a multiple of 64 kilobytes per second. One possible application of the new network, he said, would be the transmission of wideband information for digital video communication.

The ring coupler and bypass (RCB) units and the ring control logic (RCL) system are the basic building blocks of the LAN. The RCL contains hardware and software for defining the ring protocol, as well as interface controls for the user. The special design feature of the RCB is that its point-to-point connections are constructed with optical fibers, which enables the

network to be extended over distances up to several kilometers between individual units. In one example chosen by Eberspaecher, with 50 connected ring stations it would be possible to have a network length of 100 kilometers. The function of the RCB is to circumvent a defective ring control system by means of a "bypass switch."

One possible way to increase performance would be to set up the CP-LAN as a duplex ring. The reason for the second ring is especially apparent in terms of failsafe operation: in a redundantly structured double ring where information flows in opposite directions, a "loopback switching procedure" can be carried out at the stations close to the site of the failure to convert the double ring into a simplex ring. Transmission resumes after an automatic system recovery.

According to Eberspaecher, the committees of both the Institute of Electrical and Electronics Engineers and the IEC are working on the standardization of optical fiber carrier sense multiple access with collision detection (CSMA/CD) networks, and standards are expected to be adopted during the coming year.

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WEST EUROPE/COMPUTERS

PHILIPS ESPRIT PROJECT IN AI AT DEFINITION LEVEL

Brussels NOUVELLES DE LA SCIENCE ET DES TECHNOLOGIES in French Sep 86 pp 63-67

[Article by Dr Jean-Marie Goethals, director of Philips Research Laboratories in Brussels, in cooperation with G. Louis, A. Pirotte, D. Snyers, and A. Thayse: "Some Aspects of Artificial Intelligence Research at Philips Research Laboratory in Brussels"]

[Excerpts] 1. Introduction

Philips Research Laboratory Brussels (PRLB), a division of SA Philips & MBLÉ Associated, plays a special role within the group of Philips research laboratories.

On the following pages, some of the laboratory's researchers briefly describe our activities in these two fields: speech comprehension and expert systems. Our work in speech recognition and comprehension is being conducted within a project funded in part by the Belgian IRSIA [Institute for the Stimulation of Scientific Research in Industry and Agriculture]. Our work in expert systems is part of our participation in the ESPRIT program.

2. Logic Programming and Speech Comprehension (D. Snyers, A. Thayse)

The goal of speech processing is to transform an acoustic signal into a signal which can be understood by a machine. Speech is a continuous signal, whereas a machine reacts to discrete signals from specialized programming languages. Thus, in speech processing there is a threshold after which we stop using conventional signal processing techniques and begin using AI techniques. We have chosen to establish that threshold at the level of the phoneme.

This work had two goals: first, to develop vocal machine commands, and second, to evaluate an AI-produced language for this use.

The most attractive feature of logic programming is the use of a logical description of a problem in order to solve it by machine. Like other AI-based languages (such as Lisp), Prolog is especially efficient in symbolic computation. The conventional programming languages (procedure-oriented languages such as Algol or Pascal) are still the best suited for digital computation. Thus, we have chosen to use conventional data processing techniques for the

acoustic aspects of speech processing, while preferring AI techniques for grammatical analysis and translation.

The combined use of these two techniques has enabled us to create the best possible overall tool.

3. Expert Systems (G. Louis, A. Pirotte)

Conventional Programs and Expert Systems

Conventional programs free the user from a series of repetitive tasks, such as calculations and data formatting. The additional purpose of expert systems is to provide the user with help comparable to what he would receive from human experts.

The ESTEAM [Expert System Team] Project

Philips Research Laboratory Brussels (PRLB) is involved in research on the architecture of expert systems more complex than typical existing ones. This project, called ESTEAM, is part of the ESPRIT program, which receives partial funding from the EEC. PRLB's partners are CSELT [Communications Study Center and Laboratories] (Italy), Cap Sogeti Innovation (France), ONERA-CERT [National Office for Aerospace Studies and Research-Toulouse Study and Research Center] (France), and Politecnico di Milano (Italy). ESTEAM is a class-A ESPRIT project, with more than 100 man-years spread over a 5-year period.

More specifically, ESTEAM is interested in advisory systems for complex applications. The field of financial investment counselling was chosen to illustrate this research. This field of application uses expertise in interactions with users, investment problem solving, and in accessing large volumes of data. ESTEAM's architecture research involves the integration and cooperation of several expert systems (hence, the name Expert System TEAM). Each of these expert systems has a specific function contributing to the total system. In a complex advisory system, these specific functions may be extremely varied, including the definition of a problem reflecting the user's needs through interaction with the user; acquiring data essential for solving the problem from the user himself; breaking down a specific problem into simpler subproblems; tailoring a solution to each of these subproblems; selecting and accessing information sources needed to solve the subproblems; providing sufficient explanation and justification; discussing the validity of the solution with the user, and possibly revising the solution or even the initial problem itself.

A preliminary analysis suggests that the functions of these expert systems can be divided into three types of knowledge: interaction with the user, data access, and application-oriented problem solving. Architecture research consists in describing the functions and the cooperation and communication processes of the separate expert systems. Moreover, each of the three types of knowledge and their respective expert systems give rise to specific research topics:

--ESTEAM's research on interaction with the user centers on communication management and user modeling (analysis of the user's specific situation and goals as defined in terms of parameters representing a problem type, evaluation of his background and competence in the system's field of application, etc.).

--Access to large volume of data must be efficiently combined with consideration of these data, so as not to slow the system down with overly frequent inquiries to an external database management system, while at the same time avoiding overloading the inference engine with too many data.

--Application-oriented problem solving requires the choice of a knowledge representation system well adapted to solving specific problems and capable of explaining and justifying the solutions. Extensive project funding has therefore been devoted to knowledge acquisition from experts in the target field. This is a time-consuming and difficult task for which there is hardly any established methodology.

ESTEAM is still in the initial phases of clarifying preliminary architectural concepts and defining and selecting the desired function. In addition, research on expert systems, as in many other AI fields, cannot be restricted to theoretical studies and must include an extensive experimental component. Indeed, expert systems technology is still very young and documentation on recent research and developments is uneven and lacks universally accepted solid foundations. As regards ESTEAM itself, evaluation and validation of architectural concepts will be possible only after repeated stages of building, evaluating, and revising of successive prototypes.

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WEST EUROPE/COMPUTERS

BELGIAN PROLOG SOFTWARE PROVIDES STATE-OF-THE-ART COMPILER

Brussels NOUVELLES DE LA SCIENCE ET DES TECHNOLOGIES in French Sep 86 pp 57-60

[Article by Marc-Paul Antoine, BIM Director of Software Development, and Michel Vanden Bossche-Marquette, BIM Managing Director: "BIM--Working Towards a Professional PROLOG Implementation"]

[Excerpts] The BIM-Prolog Project

With the financial support provided by the Belgian Government and by the EEC under the ESPRIT project, BIM [Belgian Institute of Management], a newcomer in data processing services and engineering, has worked with the Catholic University of Louvain (KUL) since 1984 to develop a professional version of Prolog, called BIM-Prolog.

Current results are very encouraging, since the BIM-PROLOG compiler has reached a speed of 105,000 LIPS (logical inferences per second) on the SUN-3 (2 MIPS [millions of instructions per second]) workstation. At present, BIM-PROLOG is the fastest compiler in the world.

Among BIM's achievements are:

- the MC68020 (UNIX) compiler;
- an intelligent debugger, a true expert system to assist in program verification;
- a triple garbage collector (data, code, and constants);
- a module-defining capability (separate compiling and importing);
- interfaces to the INGRES and UNIFY relational DBMS's [Database Management System];
- external procedure calling capabilities (Pascal, Fortran, C,...)

In comparison with C-PROLOG, the PROLOG interpreter which serves as a reference point, BIM-PROLOG offers the following additional built-in features:

- extended input/output (stream files and logical-physical coupling);
- formatted output;
- status verification of input/output operations;
- interactive rule insertion and deletion at any point of the program;
- retention of original variable names during execution;
- global variables with typing;
- controlled backtracking within a rule;

```
--various options (infinite tree-branching control, automatic solution display,  
...);  
--graphics functions for handling window (SUN workstation).
```

The Future

Following the first development phase, which concentrated on the compiler itself, BIM is now looking at integrating it in a professional working environment, a true software workshop.

The major future steps of this development are:

```
--integration of a specific editor with the PROLOG run-time system;  
--optimized access to the internal database;  
--intelligent backtracking, avoiding dead ends whenever possible;  
--interface with deductive data bases;  
--parallelism capabilities;  
--integration in future analysis and development methodologies.
```

PROLOG'S future depends on its acceptance by the software development market, at which it is naturally aimed.

Today, PROLOG is erroneously seen as a language limited to the realm of AI, which was its origin. On the contrary, our experience in rapid development, the perfect suitability of Prolog's formalism to that of the relational DBMS's and PROLOG's natural integration within the structured design methods of data processing solutions (see figure 3) demonstrate that PROLOG is one language that is perfectly suited to creating a complete software workshop. In coming years, such software workshops will surely result in major productivity gains by data processing system developers, while ensuring the production of exceptionally high quality software.

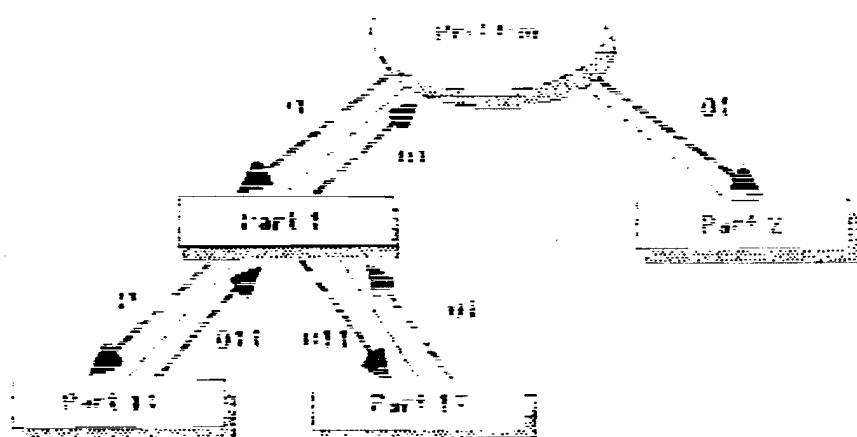


Figure 3: Prolog and structured design methods

The structure of a given problem can be easily translated in Prolog:
problem (II): - part 1 (II, 01), part 2 (01)
part 1 (II, 01): - part 11 (II, 011), part 12 (011, 01)

In addition, the imminent arrival of fifth-generation architectures, which will no doubt signal the end of several conventional languages, will only strengthen the already discernible movement towards PROLOG. In fact, PROLOG's basic principles demonstrate that conventional architecture is poorly suited to such a language, which should take the fullest possible advantage of parallelism, one of the primary characteristics of the new generation of computers.

Conclusion

The completion of a Prolog-based software workshop in the hardware environment of high resolution graphics workstations linked by a local network will soon provide an integrated and accessible system for software development companies. This solution will guarantee easy conversion to the fifth-generation environments of the early 1990's.

25051/12951
CSO: 3698/A036

WEST EUROPE/COMPUTERS

NIXDORF ISSUES STOCK, RAISES CAPITAL FOR ISDN RESEARCH

Munich COMPUTERWOCHE in German 17 Oct 86 p 124

[Article by "CW": Nixdorf Increases Capital by DM80 Million--Luft Obtains Over Half Billion Marks From Capital Market"]

[Text] Paderborn--Nixdorf Computer AG has offered its stockholders new shares at a price about 45 percent below current market value. As a result of the DM80 million capital increase, owners of Nixdorf stock can purchase a total of 1.6 million scrip certificates at DM400 apiece.

Nevertheless, response has been limited in terms of purchases of the lower-priced stock, which will be entitled to a one-quarter dividend for the current fiscal year. Nixdorf gives the ratio as 6 to 1. A buyer has to own six old shares to be able to buy one new one. The amount of money brought in by this transaction, DM640 million, will be greater than the company's capital stock, which will be DM560 million after the increase.

With this increase Nixdorf has raised two-thirds of the DM120 million in capital approved by the stockholders at the general meeting: DM40 million in the form of common stock and another 40 million as preferred stock. The company has not yet acted on the loan option of 500 million marks that was also approved.

According to Klaus Luft, chairman of the board of Nixdorf AG, the need for capital derives from the cost of the company's plans for "independent growth." Above all, it wants to invest in ISDN research and development. In addition, the company's U.S. subsidiary recently announced that it had concluded a comprehensive supply contract with the retail chain Montgomery Ward. Not only is this \$100-million deal the largest single contract in the firm's history, but it also gives it its first foothold in the difficult North American market. Luft clearly feels that larger investments will be required here as well, if Montgomery Ward is not to be the company's only success in this market. Due to the accelerated drop in the dollar, however, the profit margin on the German-manufactured hardware (about 50 percent of the volume of the contract) is much narrower than in previous transactions. The current direction of monetary policies is increasing the cost of U.S. business operations, whose capital requirements are also increasing.

13114/12828
CSO: 3698/142

FRG CONDUCTS STUDY OF ENERGY-SAVING TECHNOLOGIES

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATION in German No 440, 26 Sep 86 p 7-8

[Text] At the request of the Federal Ministry of Economics, the Fichtner engineering firm in Stuttgart and the Fraunhofer Institute for Systems Technology and Innovation Research (ISI) in Karlsruhe have examined the contributions new technologies can make to the rational use of energy in FRG industry through 1995. The study covered energy-intensive basic industries, the petroleum industry, and public electricity generation. The main objective of the study was to identify the most important technologies on the basis of economy, possible applications, and contributions to energy requirements and to evaluate the corresponding effects of a modified product structure (fewer energy-intensive products).

More than 60 technologies were examined, including those of general use, such as electronic control technology, power-heat coupling, and the use of waste heat through organic processes or heat pumps. New production methods for certain industries were also investigated, such as the membrane process with chlorine-alkali electrolysis, gas generation from converters in the production of steel with blast furnaces, and thermal and pressure wood pulp processes for the manufacture of paper.

Thanks to the use of these technologies, energy consumption by the FRG processing industry will decrease by 3.7 million tons SKE [mineral coal units] in 1995. This is just under 5 percent of current consumption. At the same time, air pollution will decrease by 3.5 percent (the difference compared to the decrease in energy consumption is due, among other things, to different energy sources). In this connection, it was taken into account that industry will use these new technologies only when the cost of investment is recovered through energy cost savings within 2 to 4 years. The energy potential which can be obtained through the maximum application of new technologies--independent of the savings factor--is about 3 times as much.

Also by shifting to more refined products with lower energy requirements, the structural change within the various branches of the economy will cause an additional decrease of 1.4 million tons SKE in energy consumption in the FRG will diminish by almost 7 percent in 1995 through the structural change and the new technologies for rational utilization of energy. This is a notable

contribution to limiting industrial energy requirements and to decreasing energy costs in companies.

The two-volume research report has been published under the title "Rationelle Energieverwendung durch neue Technologien" [Rational Energy Use Through New Technologies] by the TUEV Verlag Rheinland (Cologne) and can be purchased in book shops.

8617/12951
CSO: 3698/M035

'SPIRIT': CAD WORKSTATION

Milan AUTOMAZIONE E STRUMENTAZIONE in Italian Feb 86 p 180

[Text] Six European industrial and academic organizations combined their respective experiences with regard to the design and development of VLSI [very-large-scale integrated] circuits, and the result was a workstation--the "Spirit"--based on an open software architecture and numerous standards. The project, whose content is predominantly Dutch, is already partially a commercial reality, in that, some programs have been on the market since January; however, research on it will continue for another 3 years at least, with funding from the Esprit program, the Community program roughly the equivalent of the Japanese 5th generation computer program.

This cooperative effort has produced a range of instruments suited for use in the design and manufacture of chips in different silicon foundries. A Spirit system, say its designers, is capable of turning out circuit designs in about one-tenth the time required by present systems, adding that it generates, today, some 70 transistors a day, a level that is expected to double by the end of 1986. This points to the transformation of Spirit into a general-purpose silicon compiler. All the elements exist now. All the software is developed for operation under AT&T's Unix System 5, and the interfaces among the different software instruments have been built to standards such as will permit data to be transferred from one to the other rapidly. The user also interacts with all programs by way of a single interface.

The standards to which the software conforms include GenRad's HILO for the simulation of circuits, EDIF for the description of data relative to the integrated circuits, Calma's GDSII for the description of masks, and others.

A Spirit workstation needs a minimum of 2 megabytes of main memory, from 55 to 80 megabytes of disk storage, and a color display with graphics processing capabilities. As the processing unit, a Hewlett-Packard 9000 miniprocessor, or a Digital Equipment VAX, or also a Sel/Gould system, can be used indifferently. Dutch authorship of the project is attested by the participation of all of three universities (Delft, Twente and Eindhoven) and of another agency of that country.

9238
CSO: 3698/92

LASER-DRIVEN WORKSTATION SYSTEM

Milan AUTOMAZIONE E STRUMENTAZIONE in Italian Feb 86 pp 214-216

[Text] CISE and Alfa Romeo have patented jointly, in Italy and abroad, a power-laser-driven workstation system based on the flexible combining of several laser beams, the feasibility of which has already been demonstrated.

Schematically, the system consists of:

- A group of laser sources (two or more);
- An optical decoupling unit;
- A laser-beam combining unit;
- A unit for routing laser beams to the various workstations;
- A group of workstations.

This system can send to any of the workstations a supply of laser power equivalent to that of a single source or of the aggregate power of the beams emitted by two or more laser sources. Using three 2.5-kw laser sources, for example, a given workstation can be supplied laser power ranging from approximately 700 W to 7.5 kW, enabling it to perform the quasi entirety of the shopwork involved in cutting, welding and surface heat-treatments.

The fundamental concept underlying the development of this system has been that of maximizing the technological flexibility and performance of a power-laser system, without using high-power laser sources, which are still not sufficiently reliable for industrial use.

Presently installed at Alfa Romeo's Portello (Milan) laboratories, are two 2.5-kW carbonic anhydride lasers, designed and built by CISE. One of these sources was developed under the National Research Council's Power-Laser Targeted Research Project.

The furnishing of these two sources to Alfa Romeo by CISE marks the first transfer in Italy of laser sources of this power from a company operating in the applied research sector to one in the automotive industry.

The two sources, which presently operate independently of each other, will shortly be coupled in such a way as to constitute the first flexible laser system based on the combining of laser beams, as described above. This innovative laser-system concept is attracting considerable interest, not only in Italy but also abroad.

CISE SpA; Via Reggio Emilia, 39; 20090 Segrate (MI).

9238

CSO: 3698/92

WEST EUROPE/FACTORY AUTOMATION

BRIEFS

MBB-TOSHIBA AUTOMATION ACCORD--The Industrial Products Division, Central Region, of MBB, Munich, and Toshiba International, London, have concluded a sales and service contract in the field of robotics and factory automation. One goal of this partnership is to combine the comprehensive knowhow of Messerschmitt-Boelkow-Blohm (MBB) in the systems engineering and planning of automated factories with the experience of a robot manufacturer. And Toshiba, for its part, was looking for a European partner with experience in the development and use of factory automation and that knew how to utilize the capabilities of robotics applications. By expanding its product line to include a complete family of robots, MBB Automation Engineering will be able to offer additional hardware components for comprehensive approaches to factory automation. The two firms agreed that MBB Automation Engineering will have exclusive sales rights in the Federal Republic of Germany, Switzerland, and Austria. The robot family, which has been part of MBB Automation Engineering's product line since July 1986, covers the entire spectrum of applications in assembly, handling, and jointing technology. The control system is provided with a computer interface so that it can be integrated into the CIM project.
[Text][Duesseldorf VDI-Z in German Oct 86 p VIII]13114/12828

CSO: 3698/142

WEST EUROPE/LASERS, SENSORS, AND OPTICS

DEGUSSA INVESTS DM4 MILLION IN PRECISION RESISTOR PRODUCTION

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 440, 26 Sep 86 p 14

[Text] Air conditioning technology, processing technology, household appliance technology, medical technology, and the automobile are the most important areas of application for thin film precision resistors of platinum and iridium. Degussa AG has expanded manufacture of these precision resistors with a DM4 million investment. The primary reason for this investment is to reduce waste as well as to expand capacity and aid quality assurance. Impurities of the platinum layer, which is only 1 micron thick, are largely removed through processing in the clean room.

Along with automation, hand work still characterizes the manufacturing process of thin film precision resistors. The most important manufacturing steps are the application of the thin platinum layer to the ceramic substrate (wafer) using cathode spraying according to a Degussa patent and the meandering structuring of the platinum layer with a laser trimmer. The precision trimming of these 10-micron-wide structures with a precision of 0.1 per thousand (one ten-thousand) is a further step requiring high precision equipment and maximum attention of the operator. The cost of such a laser trimmer is roughly DM1 million.

The classic field of application for platinum thin film precision resistors as sensors is for precise, long-term stable temperature measurement from -50 °C to +600°C. The application range of iridium resistors, also manufactured by Degussa-measuring resistor technology, reaches only +400° C. However, its measuring error is about one-half that of platinum resistors. Besides temperature, other parameters such as humidity, boiling point, or pressure can be measured. Degussa thin film sensors are also used as heating elements, for example in dental technology and soldering technology. Platinum or iridium thin film resistors are the key components in sensor systems as maximum precision management and control elements. These sensor systems can help make both products, i.e., devices, and manufacturing processes user-friendly and also energy conserving for the most part.

8617/12951
CSO: 3698/M038

WEST EUROPE/LASERS, SENSORS, AND OPTICS

VOLKSWAGEN, BMFT FUND STUTTGART MICROSTRUCTURES LABORATORY

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 441,
17 Oct 86 p 11

[Text] A DM16 million research center for microstructures and optoelectronics has been established at the Physics Institute of Stuttgart University. It was officially inaugurated by the undersecretary Dr M. Erhardt, in the presence of Professor Dr Franz Effenberger, vice-rector. The costs are borne mainly by the Baden Wuerttemberg state authorities, the federal government, and the Volkswagen Foundation. Volkswagen provided a DM5.8 million grant for the heart of the microstructure laboratory, an electron beam lithographic installation which will permit research and development in ultra-thin semiconductor materials.

The main purpose of the research center is the development of new technologies for manufacturing semiconductor components of extremely small dimensions, within the range of 0.01 micron (1 micron = 0.001 millimeter). Instead of silicon, which usually is used in semiconductor manufacturing techniques, gallium arsenide and indium-gallium arsenide are used as basic materials since they are particularly well suited for manufacturing high-speed switching circuits and optoelectronic components. At the same time, the components are developed which are even smaller than the infinitesimal dimensions reached so far.

With structural elements of the aforementioned materials which are smaller than 0.05 microns, fundamentally new electrical and optical characteristics could appear which should be studied in various projects from the viewpoint of pure physical research.

A prerequisite is technological mastery of the manufacture of suitable structures. For the necessary costly operations, an "ultra-clean room laboratory" of approximately 500 sq m, equipped with the most up-to-date equipment, is available in the new microstructure laboratory. The nucleus of this laboratory is an electron beam lithographic installation from a Japanese firm, which, at the moment, is the only one in the world able to create such ultra-high resolution equipment. The installation in Stuttgart is the first of its kind in Europe and features a resolution capacity more than ten times greater than conventional installations. Other key devices in the microstructure laboratory are an ion implantation installation, new types of dry etching and coating installations, as well as highly sensitive analytical devices.

8622/12951
CSO: 3698/M057

WEST EUROPE/LASERS, SENSORS, AND OPTICS

AUSTRIAN PARTICIPATION IN 'EURO-LASER' PROJECT OUTLINED

AU071158 Vienna WIENER ZEITUNG in German 6 Jan 87 p 3

[Text] According to Science Minister Heinz Fischer, Austria will be the only non-EC member to participate — together with Great Britain, France, Italy, the FRG, and other EC countries — in the Eureka "Eurolaser" project.

This project is to ensure a leading role for Europe in the area of important high-power laser technology with respect to the United States and Japan. As the minister stressed on Monday [5 January], Austria's participation in the project constitutes a recognition of the contributions of Austrian scientists and researchers to date in the field of high-power laser technology, and ensures that Austria will not lose contact with the countries that lead in laser technology.

The science minister stressed that, as a full member of this project group, Austria will have available for its own use the entire body of knowledge which must be worked out in the field of high-power laser technology, and thus Austrian research and the economy will have access to the latest developments in this important area, while Austria will make its own contribution to the joint development work.

Subsidies for this development, which is to take place mainly in Austrian universities, have already been allocated by the Science Ministry. After the conclusion of the joint development work, two to three European companies are to build the newly developed high-power laser in series.

/6091
CSO: 3698/232

WEST EUROPE/MICROELECTRONICS

THOMSON SCIENTIST VIEWS PROGRESS IN DIGITAL GAAS IC'S

Milan ALTA FREQUENZA in English No 3, May-Jun 86 pp 165-171

[Paper by Ernesto Perea of Thomson Semiconducteurs presented at workshop on "GaAs Discrete and IC Devices: Trends in Telecommunications" in Milan, Italy, 20-21 February 1986]

[Text] 1. Introduction

The effort of Thomson semiconductors on GaAs technology and design for discrete digital and microwave devices as well as optical components, accounts for about one hundred people with a total clean room area soon reaching a thousand square meters.

The basic process adopted for digital IC's is a fully implanted process with optical photolithography but Electron Beam direct writing of the gates is used for most microwave devices.

The equipment includes a couple of Thomson E.B. machines, a 450 KV VEECO implanter and also some Molecular Beam Epitaxial reactors.

In house GaAs crystal growth is performed.

For CAD, Silvar Lisco software and Microvax computers are generally used.

2. The Technological Process For Digital IC's

The basic process, named LOG-1, was originally developed for digital IC's but now, with some modifications it is also used for analog circuits.

The first step is an ion implantation on the semi-insulating GaAs substrate through a Si₃N₄ layer. Both localized active layers and N⁺ contact layers are sucessively implanted.

Annealing process follows, using Si₃N₄ cap to avoid arsenic evaporation. Standard Gold-Germanium ohmic contact regions are defined

and evaporated.

The channel region of the MESFET is then slightly recessed (five hundred angstroms) in order to adjust the threshold voltage by monitoring the current of an ungated transistor.

The gate stripe is defined by optical photolithography followed by evaporation of Titanium Platinum Gold.

Two metallization levels are finally realized with Si₃N₄ isolation layers in between. The top gold metal layer is between 5000 Å and 8000 Å thick.

For digital applications the gate metal layers are very thin, in order to facilitate lift off process (500 Å Ti, 500 Å Pt, 500 Å Au). In the case of microwave IC's the gate is much thicker in order to reduce the distributed resistance. The LOG-1 process sequence is sketched in Figure 1 while a view of a logic IC structure is presented in Figure 2.

The isolation between integrated devices was originally performed by means of local boron ion implantation but actually local n channel implantation is preferred.

A wide process characterization is performed by means of automatic equipment and PDP11 computers.

The map of threshold voltages on two inch GaAs wafers is obtained by characterization of standard test patterns as shown in Figure 3. An interesting result is that the dispersion across the whole wafer is nearly the same as through adjacent devices (20 μm distance).

The conclusion is that these dispersions are correlated with the defect density on the wafer. This may be even more important for analog IC's where matching between identical transistors may be required.

For this reason an activity on zero defect material is planned for the near future.

3. Digital IC Design

Three design approaches are followed by Thomson Semiconductors for digital GaAs IC's:

- Full custom
- Standard cells
- Gate arrays

With full custom approach single device models are supplied. A standard cell library is nearly completed while gate array facility will be ready in the near future. The situation is indicated in Table 1 and Table 2.

In all cases the circuit approach is the Buffer FET Logic (BFL), with medium and low power characteristics and threshold voltage of about - 1 V.

4. Frequency Dividers

Both static and dynamic frequency dividers have been developed. A static divider by two, working up to 3.9 GHz is shown in Figure 4. A dynamic frequency divider by two running up to 4.2 GHz is visible in Figure 5.

Dynamic dividers by five and by six, have been developed as well for frequencies up to 3.5 GHz.

In the case of static dividers by two, the actual fabrication yields are as high as 80 percent on the wafer.

5. Standard Cells

The standard cell library includes a number of precharacterized cells and a CAD system which allows a symbolic approach. In other words the cells can be chosen and connected without concerning the actual mask layout by only logic symbols.

The basic elements are composed of an input and an output cell so that the driving capability can be adapted to the load. In Figure 6 a portion of a standard cell circuit is represented. In order to set up a cell library, the single cells have been processed individually and characterized.

The test pattern used to test the process and the cells is shown in Figure 7. It includes some transistors, some interconnected chains to test yields and mask alignment. A four bit universal register working up to 1.3 GHz clock frequency has also been realized. A ring oscillator, as shown in Figure 8, is used to measure propagation delays.

6. Gate Arrays

In Figure 9 a matrix of 324 BFL gates can be seen.

In the periphery of the gate array there are input-output interfaces

which can be configurated either as input or output circuits, which are ECL compatible.

A basic decision in the gate array organization concerns where to stop the fabrication process and store wafers. In our case, the decision has been to stop the process after the gate level and protected wafers are then stored. The two interconnect metal levels and through-dielectric vias are then left for the customized steps.

The basic cell shown in Figure 10, contains five input transistors, the level shift diodes and three output transistors.

A library of macro-elements will be developed which will be equivalent to the standard cell library. In addition a symbolic representation of all the elements will be available for the customer.

The fabrication cycle of Microwave Monolithic IC's is described in Figure 11.

The technological process either uses complete photolithographic technique or an Electron Beam Litographic step for the gate definition of the order of 0.5 m or less.

The dielectric layer is realized either with Silicon Nitride or Tantalum Oxide, for capacitors.

The technological process also includes metal air high value resistors. A high value sputtered resistor and a detail of spiral inductor with an air bridge interconnection, are shown in Figure 12 and 13 respectively.

Among MMIC's developed recently with this process there are, for example, broad band amplifiers (0.5-7 GHz) with a cascadable configuration, 6 dB Noise Figure and Associated Gain higher than 5 dB.

Other MMIC realizations include:

X band oscillators and buffer stage
optical amplifier for 140 Mbit/s
power amplifiers in the range 5.9-6.4 GHz
attenuators
phase shifters

Table 3 indicates some characteristics of Power MMIC amplifiers.

An optical amplifier consists of monolithic amplifier in the band 10 kHz - 80 MHz with a sensitivity of a few nA of input current and an output nA.

This amplifier has to be coupled to a PIN optical detector (Figure 14 and Figure 15).

8. Conclusion

The development phase for both digital and analog GaAs IC's has been carried out in the last years while the mayor effort is now dedicated to the assessment of the technology in terms of reproducibility, yields, automation, CAD and reliability. This is in view of a volume production to be started in 1987.

The basic technology for monolithic GaAs IC's and design approaches have been described in this paper.

Some significant results and products have also been shown as demonstration of the actual state of the art.

Fig.1 LOG-1 Technological process.

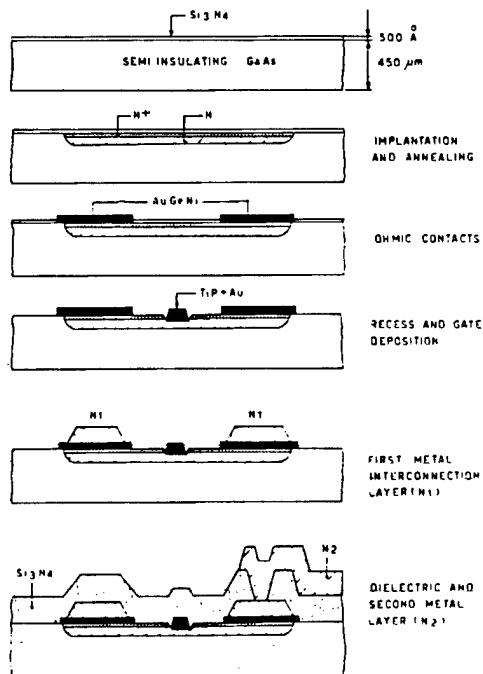


Fig. 2 Logic IC structure and cross section.

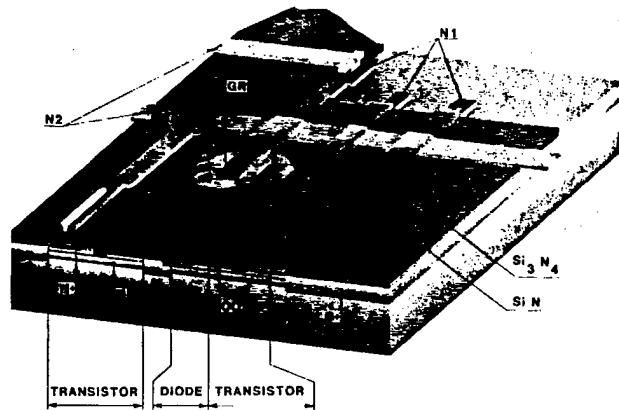


Fig.3 Transistor threshold voltage cartography obtained on standard test patterns.

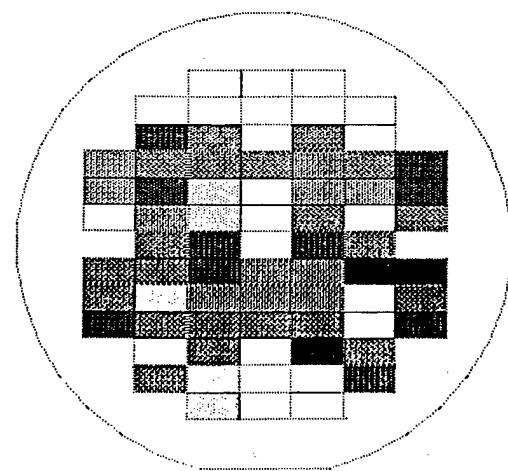


Table 1 GaAs logic integrated circuits.

Catalog products		
Frequency dividers	Samples	Now
Gates, flip-flop, registers, etc..	QTYs	87
Standard cell library	Preliminary version	Now
	Operational	Now
Gate arrays	Preliminary version	7/86
	Available	87

Table 2 GaAs digital integrated circuits (3 design approaches).

1 - Full custom:
<ul style="list-style-type: none"> • models with parameters • design rules • logic circuit <u>design rules</u>
2 - Standard cells:
<ul style="list-style-type: none"> • Library NOR (5) AND/NOR (2) NOR/OR (3) D type flip flops Current buffers ECL I/Os • Document
3 - Gate arrays (under development):
<ul style="list-style-type: none"> • 320 BFL cells • 32 I/Os • Mini library
All designs are drawn on Silvar-Lisco work stations (GDS format) and are fully compatible with Calma and other systems.

Fig.4 Static divider by two, working up to 3.9 GHz.

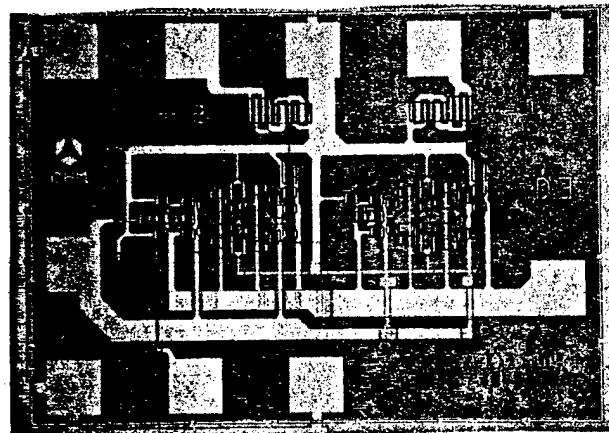


Fig.5 Dynamic frequency divider by two for 4.2 GHz operation.

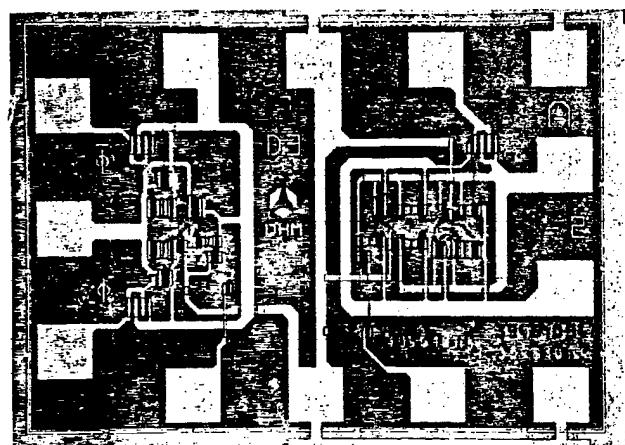


Fig.6 Standard cell circuit portion.

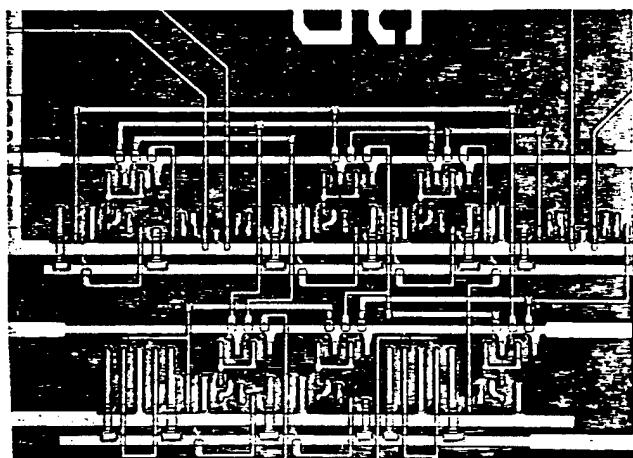


Fig.7 Test pattern used for standard cell circuits.

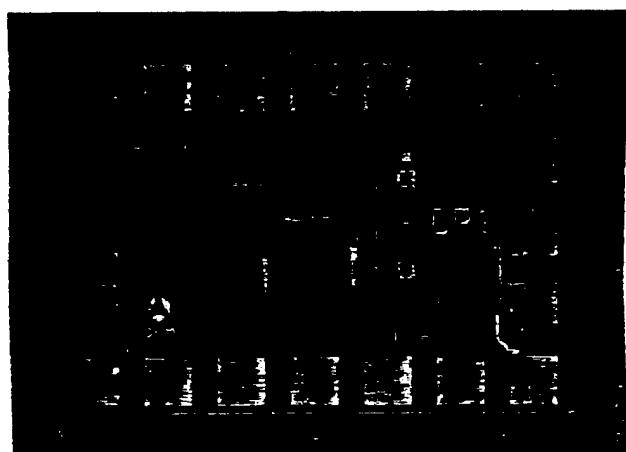


Fig.8 Standard cell ring oscillator.

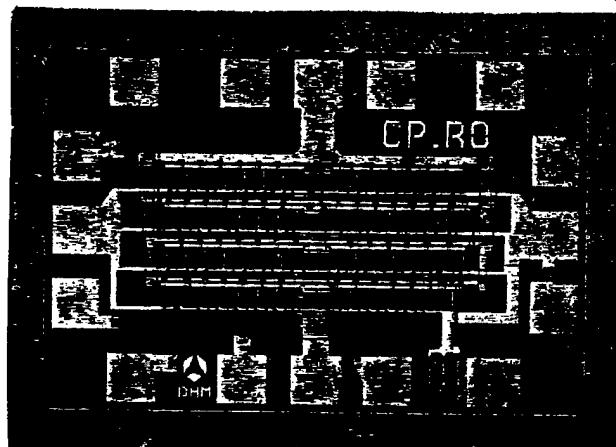


Fig.9 324 BFL gate array.

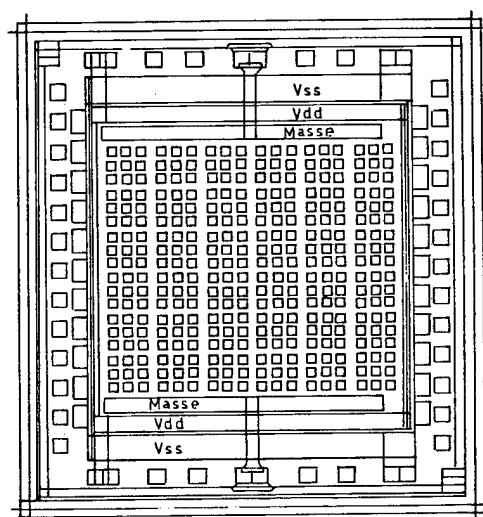


Fig.10 Basic gate array cell.

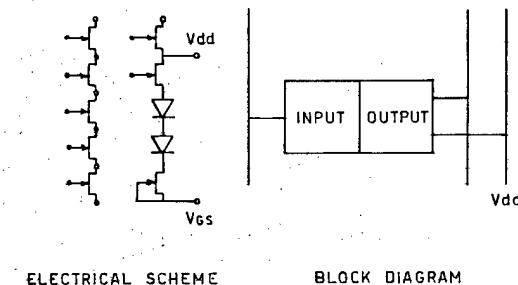


Fig.11 Design and fabrication process of MMIC's.

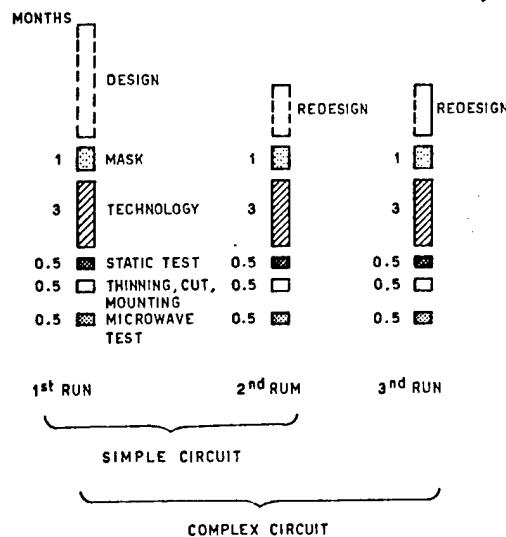


Fig.12 Sputtered Resistor for MMIC's.

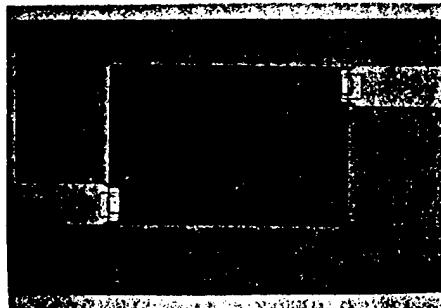


Fig.13 Spiral inductor with air bridge interconnection

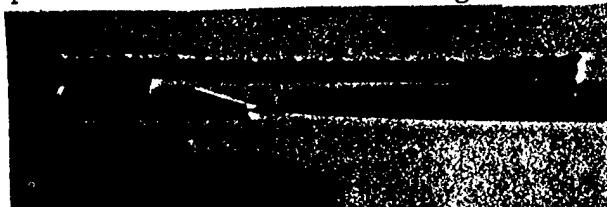


Table 3 - Microwaves

Amplifiers (5.9-6.4 GHz)	
2 Stages	$P_s = 500 \text{ mW}$ $G = 14 \text{ dB}$
3 Stages	$P_s = 800 \text{ mW}$ $G = 14 \text{ dB}$

Fig.14 Electrical scheme of the optical transimpedance amplifier

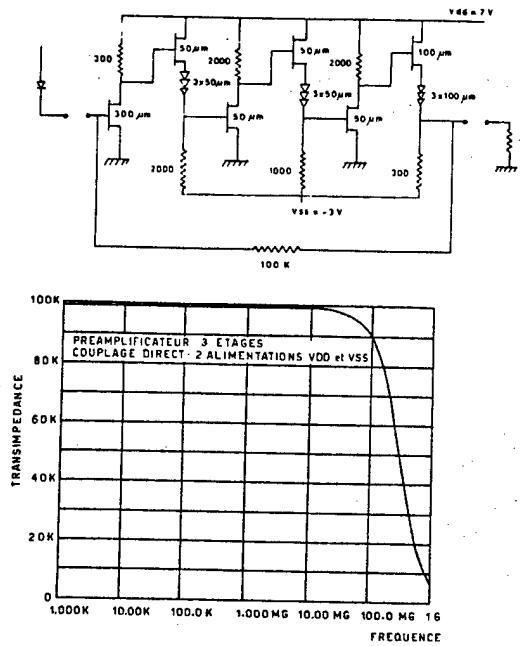
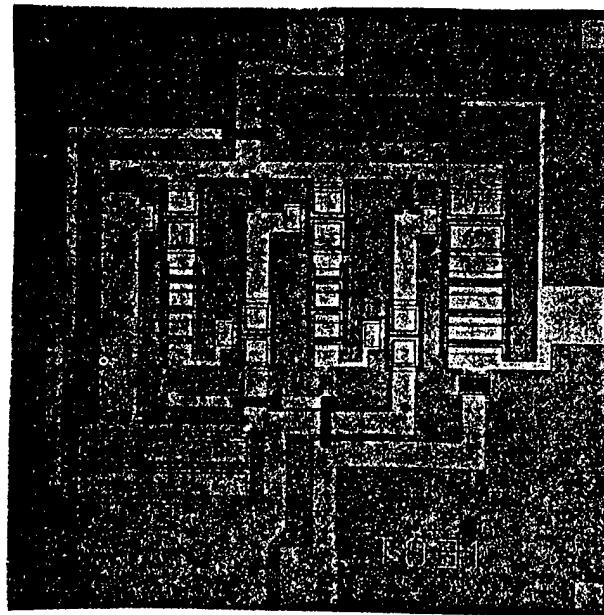


Fig.15 Picture of the MMIC optical amplifier.



8600
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WEST EUROPE/MICROELECTRONICS

ES2 ESTABLISHING REGIONAL DESIGN CENTERS

Brussels NOUVELLES DE LA SCIENCE ET DES TECHNOLOGIES in French Sep 86 pp 131-133

[Article by Thierry Watteyne, manager of integrated circuit design at Societe de Microelectronique: "Integrated Circuits: With ES2, Custom Circuits Become Accessible to Everybody"; first paragraph in NOUVELLES DE LA SCIENCE ET DES TECHNOLOGIES introduction]

[Excerpts] The European Silicon Structures company (ES2) is turning the European custom integrated circuits industry upside down. Using the most advanced technologies, i.e., silicon compilation for design and direct writing on the wafer for manufacture, ES2 enables system designers to develop their circuits directly on the silicon with cost and time factors comparable to those of printed circuit board production. ES2 has already established a foothold in Belgium through an exclusive-agency agreement with SDM (Societe de Microelectronique). SDM will open a new design center this year which will be accessible to clients. It will be equipped with the most advanced design equipment.

3.ES2

Founded in late 1985, the European Silicon Structures company (ES2) is a European multinational company in terms of both its shareholders and its activities.

Formed with private funds invested primarily by the big names in European electronics and data processing (Bull, Philips, Olivetti, British Aerospace, Brown Boveri, Telefonica, etc.), the company has offices in three European countries: France, Germany, and the UK.

In addition, a widespread network of design centers is being built throughout Europe to move design functions nearer the end user.

ES2's creation comes at a time when developments in microelectronic design and production methodology have made ASIC [Application Specific Integrated Circuit] design accessible to every electronics systems design engineer. Today, use of ASIC's is becoming a necessity for any systems manufacturer wishing to improve the performance and competitiveness of his products.

The philosophy behind ES2 therefore centers on the widespread distribution of user-friendly, low-cost design equipment, which allows more electronics engineers to design their own integrated circuits.

This is the same idea that led to the widespread use of the MDS (Microprocessor Development System), which enables thousands of electronics engineers to design their own microprocessor systems.

In contrast to the conventional approach, ES2 is organized for mass production of designs rather than of physical circuits. For this, ES2 counts on two fundamental assets.

At the design level, workstations equipped with powerful silicon compilers provide systems engineers with a convenient low-cost way to design their own fully customized integrated circuits. Emphasis is on user-friendly programs, training, and efficient flexible support through design centers close to the customer.

At the manufacturing level, electron beam writing directly on wafers has substantially reduced the cost and time required for prototypes and small production runs. In contrast to conventional manufacturing, which is organized for maximum production, the ES2 plant has been designed to best handle the largest possible number of prototypes, i.e., designs in the shortest possible time. The goal is to reach a complete production cycle of 2 weeks. Radical reorganization of production procedures was obviously necessary to reach these goals. Current technology is a state-of-the-art 2 micron CMOS with 2 layers of metal.

While the process of direct writing on 5" wafers is optimal for prototype manufacture, it is also economically advantageous for small production runs of 5,000 to 10,000 pieces.

For larger volume production, ES2 has second-source agreements with manufacturers who have compatible CMOS technology.

The ES2 design and customer support structure is based on three large centers in Paris, London and Munich. In addition to these three main centers, there are "franchised" design centers serving all other European countries.

For Belgium, an exclusive-agency agreement was concluded with SDM. This agreement led to the creation of a new ASIC design center in Brussels. This specialized design center is equipped with ES2 workstations and gives Belgian electronics engineers ready access to all the ES2 design and production facilities.

The workstation selected by ES2 are 32-bit machines on UNIX which provide complete powerful design tools.

The smallest system is the Whitechapel Computer Works MG-1 with SOLO software. This very compact system handles complete design of circuit with up to 5,000 gates.

It automatically produces the circuit layout on the basis of a logical diagram or a description in a specialized language ("Hardware Description Language"). SOLO also has a logic simulator which permits complete design verification. It has standard cell libraries. In addition, the user can create his own function libraries. This remarkable workstation is outstandingly user-friendly and easy to use. After only 2 to 3 days of training, an electronics engineer with no special microelectronics knowledge can design a highly complex integrated circuit right up to the layout.

A more powerful workstation is also available for designing more sophisticated circuits. This is the Masscomp station with SDA software, a powerful silicon compiler capable of producing very complex circuits and of hardwiring repetitive functions--such as RAM and ROM memories, PLA's, registers, ALUS, etc.--in addition to the basic functions of conventional standard cell libraries. It is equipped with all the verification tools required to validate major circuits: logic and analog simulations, testability analysis, test vector generation, etc.

Although ECHO requires somewhat more training than SOLO, it is still a convenient way for systems engineers to make their own VLSI circuits, designing their systems or subsystems directly on the silicon.

4. Conclusion

These most advanced CAD facilities are available to systems engineers at SDM's new design center in Brussels.

This is Belgium's center for all ES2 products, offering a full range of design services, from straight sale of SOLO and ECHO software to complete circuit design.

Through ES2, SDM now offers the widest possible choice and the highest performance solutions in the field of custom integrated circuits.

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CSO: 3698/A038

SGS MICROELETTRONICA ANNOUNCES 1986-1990 R&D PLAN

Milan SELEZIONE in Italian No 10, Oct 86 p 11

[Text] To become a "billion dollar" company and occupy a place among the world's 15 greatest producers of semiconductors: this is the ambitious challenge for the 5-year period 1986-90 launched by the managing director of SGS, Pasquale Pistorio. Despite the world crisis in the semiconductor market in 1985, Dataquest confirms that SGS is continuing its progress in the world classification of major producers: between 1984 and 1985 it moved from the 19th to 17th position as regards semiconductors and from 21st to 20th for integrated circuits. In Europe in the IC field, SGS is now second only to the giant Philips/Signetics. More aggressive management and an international perspective have contributed to the company's recovery, although it has not yet actually shaken off all its old problems (indeed, certain problems became more serious when, between the end of 1985 and the beginning of 1986, the world semiconductor crisis persisted). However, this recovery has been helped considerably by the contribution of research and development, which is constantly evolving. SGS today, in addition to the many joint research agreements made with several international companies -- to which Siliconix was recently added -- is one of the most active promoters of Community and national programs in the microelectronics field. The R&D activity in the Stet company (there are constant rumors concerning the entry of private shareholders) is divided between central research and development, located in Agrate, and divisional R&D, carried out in the four outlying laboratories.

There are 350 people employed at the central research level, and the same number work at the divisional level. While divisional research deals primarily with product development, central research essentially concentrates on technological research, particularly for devices of less than 2 microns (CMOS and NMOS technology). In 1985, SGS spent a total of approximately 80 billion lire on research and development, the equivalent of approximately 15 percent of its sales volume. In past years this percentage varied between 12-13 percent.

In the near future, the main endeavor of the company seems to be directed toward new VLSI (Very Large Scale Integration) techniques with component integration of more than 100,000 and up to 1 million chips, and the development of semicustom techniques (for specific problems in various manufacturing sectors). These undertakings will require further R&D efforts.

For the next 5-year period, 1986-90, SGS forecasts investments in research and development of approximately 500 billion lire (an annual expenditure equivalent to 17.5 percent of sales volume).

WEST EUROPE/MICROELECTRONICS

INCREASE IN THOMSON PROFITS COMES FROM MILITARY BUSINESS

Paris ELECTRONIQUE ACTUALITES in French 24 Oct 86 p 24

[Text] Statements to the press and to financial analysts by top officials of Thomson-CSF indicate beyond any doubt that the firm has overcome its difficulties and is about to enter a period of expansion. The firm's net profit of 1.2 billion francs for the first half of the year is undoubtedly but the first step in an ascendant phase.

Most of this profit is clearly attributable to the Equipment and Systems Division; in other words, military activities. The latter Division accounts for two-thirds of the annual revenue (15.77 billion francs in all for the Group during the first half). The Division's leverage stems from its order bookings of around 70 billion francs, ensuring some 3 years of work.

Role of Major Contracts

This preeminence of the military sector evidently "sets tongues wagging." A large portion of the orders consists of the famous Al Thakeb contract with Saudi Arabia. Thomson-CSF, however, points out that its order book includes only that portion of the RITA system contract with the United States in which the French firm is involved for the year, without including the deliveries to be made in the succeeding years, and that 5 billion francs in new orders received during the first half are, most of all, from developed countries (United States, Germany, and NATO).

Al Thakeb also gives rise to comments from a financial viewpoint, because of the size of the advance payments Saudi Arabia has made and the fact that Thomson-CSF has known how to put them to good use.

Actually, it might be said that Thomson-CSF operations, when isolated from other elements, show a loss of around 300 million francs for the first half, and that the profit comes from financial gains, representing, in large part, the revenues produced by 27 billion francs or so of advance payments made by clients and managed by the Group.

In fact, however, as pointed out by Christian Aubin, chief financial officer, advance payments are part and parcel of the overall negotiation of a

contract. Their role in the profit a company can make on them is entirely normal. On condition, that a company not spend its money before getting it, as has happened at CSF in the past. This is why its treasury is managed by a specific subsidiary, which does not release profits until the financings necessary to the execution of the contract are assured as the work proceeds.

Over 2 Billion in Profits Expected in 1986

As for the operations loss, it is normal to the extent that the Group has worked without billing. This extent appears in the balance sheet as an increase of approximately 1.5 billion francs of work in progress. This work will be billed during the second half of the year and in 1988. Barring any unforeseen accident, the profits should continue rolling in over the 2 or 3 years ahead, and the company's projection of a profit of at least 2 billion francs for the present year appears rather conservative. The vast majority of the financial analysts are in agreement that the firm can count on further rises in profits in 1987 and 1988.

It should be pointed out also that the Medical Branch has turned profitable, whereas not long ago its return to profitability was deemed problematical. As of the end of June it had increased its billings by 30 percent and had captured 45 percent of the U. S. mammography market. A profit of some 100 million francs is possible in its case.

The Components deficit will shrink and, if budgets are met, disappear next year. The Thomson-Mostek subsidiary is already showing a profit.

In view of the respectable profits the Alain Gomez firm is on the verge of reporting, it is well to recall that its losses exceeded 2 billion francs in 1982, and that as of yearend 1983 its cash reserves were 300 million in the red. Today, they are 6.7 billion in the black.

This astounding turnaround is owing to the merits of the company, but also to a series of calls upon the financial market for 5.5 billion francs over a period of 3 years. Such an infusion of capital was possible only because of very favorable market conditions, the use of all the new financial tools (convertible bonds, detachable warrants, detachable bonds issued with stock purchases), and government aid, with the parent company, Thomson SA, taking its share of the reconstitution of its large subsidiary's cash reserves.

The synthesis of the combined analyses that can be brought to bear on the question boils down to the curve of the company's stock on the Exchange: For the past 3 years, its value has almost doubled annually; thus, it has risen as high as eight-fold in just a little over 2 and 1/2 years.

9399

CSO: 3698/115

WEST EUROPE/MICROELECTRONICS

FRENCH INDUSTRY, PTT MINISTRY ANNOUNCES FINALIZED 1987 BUDGET

Paris ELECTRONIQUE ACTUALITES in French 7 Nov 86 p 2

[Article by R. Vaillant: "3 Billion Francs for Electronics Sector"]

[Text] The Ministry of Industry and PTT budget for 1987 provides for subsidies to the electronics and data processing sector in the amount to 2.54 billion francs, versus 2.38 billion francs in 1986 (revised budget law), not counting capital grants, which for the sector's groups will amount to not more than 0.7 billion francs in 1987 (versus 2.1 billion francs last year).

This is what Mr Alain Madelin, minister of industry, PTT and tourism, indicated in submitting his 1987 budget bill to the Chamber of Deputies on 31 October.

The minister stated that the subsidies will be accessible to the PME's [Small- and Medium-Sized Business(es)] and will be oriented more towards "precompetitive" research.

Altogether, the appropriations earmarked for the electronics and data processing industries in 1987 will total over 3 billion francs.

As regards the CNES [National Space Studies Center], its budget will increase "sharply," said the minister: From 4.8 billion francs in 1986 to 5 billion francs in 1987.

Further with regard to the space domain, it is to be noted that 210 million francs (substantially the same amount as in 1986) will be allocated to the Telecom 1 satellite--and not Telecom 2, a project still not considered to be sufficiently advanced to warrant budgetary commitments--and will be devoted essentially to the development of ground station networks and to the operation of the satellites in orbit.

In the PTT supplementary budget, on the other hand, 1987 payment appropriations earmarked for telecommunications equipment total 30.6 billion francs (+6.5 percent).

The CNET [National Telecommunications Studies Center] budget for next year will amount to 1.69 billion francs, with another 2.3 billion in research and development contracts for the DGT [General Directorate for Telecommunications].

It is to be noted that, in his report on the supplementary budget bill, submitted in the name of the Assembly Committee on Production and Trade, Mr Ladislas Poniatowski (UDF) emphasizes the "urgency of a sizable outlay for R and D" in telecommunications, at the CNET level, and particularly in regard to components, terminals, ISDN [Integrated Services Digital Network], and software engineering.

In another regard, Mr Poniatowski estimates the DGT's indebtedness to be between 115 and 120 billion francs as of 1986, or double its 1980 level. "It is high time now," he writes, "to stop considering telecommunications as the general budget's milch cow."

Teletel program funding is to be 2 billion francs in 1987.

In addition, program authorizations totaling 2.2 billion francs are provided for in the 1987 budget bill (versus 2.8 billion francs in 1986) for the Wideband Network project. The Data Processing for All plan will have a budget next year, as in 1986, of 450 million francs.

On the other hand, a reading of the Ministry's "budgetary blueprint" indicates the elimination of appropriations--1.5 billion francs in 1986--for standardization and quality control of electronic components.

'Rein In the Government'

Furthermore, as regards the cable plan, the Ministry emphasizes "that the previous commitments will be honored, and that the industrialists' work loads will be maintained during the years ahead"; but that "by no means can the whole of France be cabled and wired at the same tariff." New formulas will be offered to the local governing bodies, allowing elected officials the freedom to contract out the work and negotiate prices.

Among other information provided in the page after page of the various 1987 budgetary documents, we find that the Transfix service should have 1,900 subscribers by yearend 1987 (versus 650 at yearend 1985), and that as regards Transpac the number of terminal connections should total 44,500 by the end of next year (versus 31,410 at the end of 1985), with a rise in net revenue from 13.6 million francs in 1985 to 17.9 million francs in 1986.

In his remarks to the Assembly, Mr Madelin indicated that the telecommunications sector--as also the energy sector--will be "progressively" deregulated and subjected to competition, "in order to align France with its principal partners."

In the nuclear domain, the Central Security Service for Installations budget for 1987 shows an increase of 10 percent. AEC appropriations, on the other hand, are increased by very little, said Mr Madelin. Work will center, essentially, on the development of submicron techniques, isotopic separation, and improvement of pressurized water reactor performance, the minister stated. We must maintain our technological leadership in the nuclear domain, he said, and "capitalize our gains."

Further as to the Industry Ministry's budget, quality-improvement funding appropriations--mainly for standardization systems, testing centers, etc-- show an increase of 11.1 percent; and the National Weather Bureau's budget is doubled.

Insofar as concerns innovation, ANVAR [National Agency for the Implementation of Research] will be able to dispose of 820 million francs in grants-in-aid (versus 790 million francs in 1986). But 80 percent of these grants will be going to PME's, versus 60 percent to date, Mr Madelin remarked.

On the other hand, he indicated that, as regards energy savings, more emphasis will be placed on private-sector initiative. "The AFME," he said, "will be reoriented towards research and informational activities, and its budget substantially reduced." New incentive mechanisms to stimulate investments in energy conservation are presently under study: They should be less costly to the state.

As regards the reorganization of his ministry, Mr Madelin explained the plan to put in place, in particular: A Communications Industry and Services Industries Service; an Industrial Capital Goods Service; a Basic Industries and Producer Goods Service; and a Consumer Goods Service. Also to be created are: An Innovation and Industrial and Technological Development Service; a Competitive Environment Service; and a Regional Action Service for Industrial Competitiveness and Security. The DIELI [Directorate for the Electronics and Data Processing Industry] will be abolished.

In Mr Madelin's view, the Industry Ministry's function today is to develop "another way of thinking." And, he added, to "rein in the Government."

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WEST EUROPE/MICROELECTRONICS

BRIEFS

SIEMENS, PHILIPS JOINT CHIP PRODUCTION -- Philips and Siemens are finalizing the details of a new agreement for cooperation in the electronic components sector in addition to that which already exists in the area of highly integrated memories. The new undertaking concerns chips to be used in the production of ISDN networks. Initially, the two companies will become each other's second source of circuits produced for such applications. Subsequently, an extension of this collaboration is forecast in an attempt to block the way into the European market of American and Japanese manufacturers of telecommunications chips. [Text] [Milan SELEZIONE in Italian No 10, Oct 86 p 12] 8627

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

FRANCE'S CESTA REVIEWS HIGH TECH STRENGTHS, WEAKNESSES

Paris L'EXPANSION in French 24 Oct 86 pp 102-107

[Article by Remy Dessarts: "Technologies: Alert. Why European High-Tech is Being Outdistanced"]

[Text] Honda, world Formula 1 champion? Despite Alain Prost's efforts, the hypersophisticated Williams of Nigel Mansell and Nelson Piquet have pranced all year in the lead of grand prix races, thanks to the fearsome engine of the Japanese manufacturer, perfected under the greatest secrecy by an army of slant-eyed technicians. As a result, the European racing stables are lining up at the Nipponese builder for the right to use the miracle engine in 1987.

Unthinkable only 10 years ago, this evolution perfectly illustrates the new hands being dealt in the coveted and strategic world of advanced technologies. Japan is taking giant strides, making up for the ground it has lost to the United States. Is Europe still one of the fighters in this battle among titans? The many indicators which provide an (imperfect) measurement of technological competitiveness--balance of patents, exchange of high technology products, industrial specialization, consumption of semiconductors per capita, and so on--are almost all oriented in the wrong direction. A multitude of studies and analyses based on these figures have given rise to the concept of "Eurosclerosis," a pessimism skillfully fostered by the Americans and the Japanese, who are only too glad to thus continue to attract our most brilliant minds. Psychological warfare is part of the technological war.

What is really happening? For a clearer picture of the Europe-United States-Japan technological competition, we have chosen a two-pronged approach.

On one hand, the Center for Higher Studies in Advanced Technologies (CESTA), a public agency very involved in the Eureka program, has taken the risk of evaluating exclusively for L'EXPANSION, the technological level of the three powers competing in all the disciplines deemed critical for the future. The verdict of CESTA's experts is that the United States leads in most areas, but that Europe is still not too outdistanced by Japan, the remarkable level of our research teams making up for our industrial deficiencies.

On the other hand, we wanted to draw an inventory of what either impedes or fosters technical progress in Europe, by asking several gurus in this field. The bottom line is that in order to close the gap, European technology will have to overcome seven major handicaps, but that it also holds three trump cards; the latter at least still justify some hope.

The Seven Handicaps

1. Not Enough Engineers and Researchers

According to a recent study by the European Commission in Brussels, Europe trains 260 engineers per million inhabitants every year. During the same time, the United States trains 360, and Japan does even better with 630. This partially explains a distressing change disclosed by OECD experts: between 1974 and 1982, the total number of researchers and engineers per thousand active workers went from 4.2 to 5.2 percent in Japan, 5.6 to 6.4 percent in the United States, and only 3 to 3.7 percent in Europe. This is what John Marcum, OECD science director calls the "lack of an adequate talent base" in Europe. For him, this is the primary cause of the Old Continent's difficulties in technology. "Just think, 90 percent of all the scientists and engineers ever born are alive today," he exclaims. "We are going through a phase of major changes, and any shortage proves to be crucial. The European education system is too elitist. It would do better to follow the example of the United States, which trains many ordinary engineers."

All the more reason to be concerned about the exodus of many young researchers to the New Continent every year. The presence of dozens of European minds, notably French ones, in the laboratories of biotechnology or computer companies around San Francisco, should not be a cause for national satisfaction. "At this rate, 100 percent European Nobel Prizes will become a rare commodity," predicts Jean-Jacques Salomon, professor at CNAM.

2. Research Too Sheltered from Competition

All the figures show that Europe spends about as much on its public and private research as the United States and Japan. But this money apparently produces fewer results. Why? The main weakness is that in Europe, university and public research is not sufficiently spurred by competition. "A large portion of European research operates in a comfortable cocoon sheltered from any Darwinian selection," deplores Andre Danzin, European Community advisor. "This is exactly the reverse of American universities, which are brought into competition through systematic publication of their results."

This lack of competition is worsened by the fact that European public agencies remain the overprivileged performers of research, with enterprises playing no more than an inadequate role. In 1984, the research carried out by enterprises amounted to 1.2 percent of the GNP in France, and 1.5 percent in the United Kingdom, but to 1.7 percent in Japan and 2 percent in the United

States, where large national agencies such as NASA or the American Science Foundation are ready to direct their resources toward private companies. The single European exception is virtuous Germany, where research conducted in enterprises was proportionally slightly higher than in Japan in 1984.

3. Poor University-Business Communications

"Recently, a French university researcher requested a waiver from a minister, to join the board of directors of a high technology company," an OECD expert relates. "The best response he got was to send his wife in his place." This anecdote perfectly sums up the mediocrity of university-industry relations in Europe. Legally, it is almost always impossible for a scientist from a European country to practice his skills both in university laboratories and in the private sector. This cloistering is a major handicap compared to the United States, where the large universities are granting increasing freedom to their researchers. The latter are helped by a powerful venture capitalism, and by the certainty that if they return to the bosom of the university, they will not be greeted as deserters.

The magazine LA RECHERCHE wanted to take stock of French scientists who have become company heads, and found only a handful. "On the other side of the Atlantic, company directors come to lure away researchers from the universities," relates Jean Cantacuzene, scientific advisor at Total. "Here, such a practice is considered an insult both by industry and by the university." All the blame does not fall on educator-researchers. "With two or three exceptions, industrialists do not know what is happening in European university laboratories," regrets Christian Marbach, head of ANVAR. Can enterprises contribute widely to the financing of university research, while still accepting the publication of results? In the United States, this is common practice. In Europe, not yet.

4. An Inadequate "Old Technology"

"In Europe, business is not sufficiently interested in what is being done or what is happening elsewhere," states Pierre Aigrain, former minister of research and currently Alain Gomez' advisor at Thomson. In an era in which technological obsolescence is accelerating, the "old technology" is the antithesis of luxury. The Japanese have understood this very well. The authors of a brilliant article on the state of technology, published by the magazine SCIENCES ET TECHNIQUES, closely analyze the "absorption strategy" of Japanese enterprises, which allow them to play "technological leapfrog." "For the Japanese," they say, "it is a sin to research that which has already been researched elsewhere." To be sure, this is expensive; Nippon Electric Company supposedly employs nearly 200 people as industrial tourists over the globe. But the returns are much greater.

In general, Japanese business does not stint on long term trip expenses. Their earnest employees survey international fairs and meetings laying in wait for new developments; many of them for instance visit the European Patent Office in Munich. And when they do not travel, they read extensively. "In Japan, personnel desks are stacked with all types of documents, which everyone

starts to read in the morning," says Thierry Gaudin, director of the Center for Forecasts and Evaluation at the Ministry of Research. "I met a French company head who, in Japan, learned things about one of his neighbors, actually located in his own industrial zone."

The Old Continent businesses do attempt to observe the Japanese on their own grounds, but the results are sometimes baffling. "Several years ago, I had assigned one of my staff to Japan so that we might benefit from what he saw," explains the scientific director of a large enterprise. "After a while, we found out that he had sold a large number of patents and licenses to the Japanese. In particular, they had bought from us at a very low price, many inventions that we had not been able to develop!"

5. Technological Chauvinism Causes Wasted Efforts

Convinced that they would have to retain at all costs the mastery of various technologies that were considered strategic, the European countries developed policies whose major beneficiaries were jealously protected national standard bearers. The consequence was an impressive amount of efforts carried out in parallel by groups that were too small to vie with the Japanese and American giants. "Technological nationalism is one Europe's greatest errors," observes John Marcum. "It would be better off spending more to train technicians, rather than multiply duplicate jobs in research and development." As a example, Europe now has two fighter plane projects.

In telecommunications, the protection of national public markets did at first encourage the rise of seven or eight European industrial groups. But from now on, in the light of international competition and according to specialists, these companies are too small by half and two times too many.

On the other hand, the field of active components (integrated circuits) is collapsing, and the belated combination of Philips' and Siemens' efforts, which should soon be joined by Thomson, is not yet sure of success. Siemens in fact has prudently also forged an alliance with the Japanese company Toshiba, so as not to fall even further behind.

6. The "Big Market" Does Not Exist

Undersized national markets, different standards from one country to the next, a great deal has been said about the consequences of Europe's inability to abolish its internal constraints (see page 278 of Richard Clavaud's investigation). Yet, the resources needed to remain in the race are increasingly huge. How can European businesses possibly obtain them without a domestic market equal to those available to their Japanese and American competitors? "We sing of Europe and make no progress," complains Jean-Jacques Salomon. "Under these conditions it is logical for European businesses to more readily sign agreements with Japanese and American enterprises."

What is true for enterprises is equally true for researchers, who are often more familiar with the work of their American colleagues than with that of their European neighbors. "In research as well, an enormous amount of money is wasted for lack of cooperation," explains Andre Danzin. "European researchers cooperate less with each other today than during the Renaissance!"

7. Conservative and Apprehensive Mentalities

A Europessimist among Europessimists, Jean-Jacques Salomon links Europe's handicaps to a much broader psychological context. "Europe is the oldest industrial civilization; it has fought strongly to reach this position. But today, our collective alternative is the pursuit of security (see Germany with the atom) and the defense of the benevolent State. Unable to control the instruments of its power, Europe is in danger of becoming a new Greece. Greece, you know, is not so bad! It's a great tourist country, and the Greeks are good innovators, but not at home!"

Andre Danzin's analysis is less dramatic: "Europe has scored in sectors where the market does not penalize. As soon as the planned economy--that is, socio-Colbertism--comes to an end, it does not respond. Europe uses oral contraception against innovation; for instance, customers to test innovations are very hard to find. In the United States on the other hand, every new product spreads like wildfire."

"It is a matter of mentality," believes Yves Stourdze, CESTA director. "In the 1970's Europe was guided by men of the 1960's, coming from the large heavy industries which they endeavored to protect. To prepare for the end of the century, a new generation will have to succeed them." For Joel de Rosnay, everything takes place as if the chain reaction indispensable for the proper development of innovation did not start on the Old Continent. "Europe has all the necessary ingredients," he assures. "But what is lacking is the critical mass of intelligence from which the system begins to self-feed." This sentiment is shared Albert Bressand, prime mover of the Promethee think-tank started by Michel Albert: "European organization and mentality do not allow the snowballing effects necessary for technological development."

The Three Trumps

1. Quality Technological Potential

"Europe's best card is its long scientific tradition," concludes John Marcum. The Old Continent still has a remarkable research potential. Its only problem is to use it effectively." This diagnosis is shared by all the experts. "It is not certain that Europe is lagging in advanced technologies." explains Thierry Gaudin, "There is nothing we would not know how to do."

To the undisputed know-how of European scientific teams can be added the efficiency of a swarm of large and intermediate enterprises which are often equally matched in their fight against their Japanese and American competitors; Thomson, Olivetti, or Siemens are leaders in many fields. Another

undeniable strength of the Old Continent is the remarkable success of industrial cooperation projects in such demanding activities as aeronautics (Airbus), space (Ariane), or nuclear power (breeder reactors).

Lastly, technopoles, convergence points for researchers from universities and enterprises, thrive almost everywhere in Europe: Cambridge, Orsay, Sofia-Antipolis, Belgian Flanders, the Turin region, as well as Stuttgart and Munich, the dynamic capitals in southern Germany. European Silicon Valleys? Not entirely, because without government help these hubs would find it difficult to develop on their own; but maybe they do signal an awakening.

2. Healthy Self-Examination

Before an illness can be treated, the patient must first be convinced that he is sick. This is fortunately the case in Europe. A multitude of studies--from EEC, OECD, or Electronic International Corporation, directed by Abel Farnoux--are alerting public opinion and officials. Stimulated by viscount Etienne Davignon, responsible for industrial matters in Brussels, the European Commission started a whole series of programs in the 1980's, designed either to encourage cooperation at a precompetitive stage among industrialists who until then has only glared at each other (Esprit, Race), or to foster the dissemination of new technologies in traditional industries (Brite). At the present time, no one questions the good results of these actions, notably improved communication among the large European companies. In fact, Michel Carpentier, a Frenchman who heads the division responsible for Esprit and Race in Brussels, is pleased to say that "manufacturers now want our programs to take effect earlier in the production process."

To encourage cooperation at the production stage, is precisely the goal of Eureka, initiated by France. Here too, it is already possible to speak of success, since even the most reticent countries such as Germany and England, have fully joined the program. Manufacturers and projects are crowding in, which actually threatens to create some coordination problems.

To be sure, a wealth of agreements between European companies and American or Japanese giants is also being noted (one of the latest being the ITT-CGE agreement), but it is not against the rules to play on two boards at the same time.

3. Not Impossible To Skip Steps

For the most optimistic specialists, not die is cast. Areas such as computers or microelectronics, whose major characteristics are strong dissemination into the economy and fast growth, are evolving fields, where breakthroughs are often unpredictable. "The essential difference between the new technologies and steelmaking is that they are genuine playing fields where you can fall behind, but also catch up," believes Andre Danzin. How? By betting on Europe's ability to use modern technologies, rather than on the policy of assuring their production at any cost. "The cultivation of new uses for technology is more important than that of new tools," explains Ricardo Petrella, in charge of the Fast program in Brussels. "Europe must therefore

strive to master the dissemination of computer technologies, and for this, it must generate new applications. Thus, if Thomson and Bull do not create new teaching processes (software notably), they run the risk of losing the school market for computers."

In conclusion, Europe will have to bet both on software and hardware, and for the latter, concentrate its efforts on areas of excellence (according to Andre Danzin's expression) such as telecommunications and space, which offer the advantage of drawing on the whole electronics spectrum. "It is not so important to fully control all the technologies, what counts is to rapidly move from one relay to the next," observes Albert Bressand.

It follows that over the longer term, Europe could even turn its structural handicap--fragmentation into several countries of different cultures--into an advantage. "Future technologies will make it possible to disregard differences," predicts Yves Stourdze. "We will exploit the complementarity of the European countries!" Or in the words of Joel de Rosnay: "If we go about it the right way, we can hope to transform our cultural anthill into a fantastic, internationally competitive machine."

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

FRANCE ANNOUNCES NEW ORGANIZATION OF RESEARCH MINISTRY

New Departments, Responsibilities

Paris AFP SCIENCES in French 18 Dec 86 pp 1-4

[Article: "R&D - France: Reorganization of Research Ministry"]

[Text] Paris--Before leaving the Ministry of Research and Higher Education, Mr Alain Devaquet took the time to complete the reorganization designed to simplify its administrative structures and to tighten somewhat and regroup certain departments and directorates.

The decree concerning this "organization of central administrative services in charge of research placed at the disposal of the minister delegate to the minister of national education, in charge of research and higher education," was dated 6 December and published in the JOURNAL OFFICIEL dated 11 December.

The decree was signed by prime minister Jacques Chirac, by Alain Devaquet and Rene Monory, by Alain Madelin, minister of industry, and by Mr Herve de Charette, minister delegate in charge of public administration and the Plan, and Camille Cabana, the minister in charge of administrative reform.

From now on, the services thus made available are the following:

1. The high defense official;
2. The Legal Mission;
3. The General Directorate of Defense and Technology, which includes:
 - the Directorate of Research and Programs;
 - the Department of Surveys and Programming;
 - the Delegation to Research;
 - the Delegation to Innovation and Technology;
 - the Delegation to Scientific and Technical Information;
 - the Directorate of Research Financing;
 - the Department of Scientific Employment and Research Administration;
 - the general secretariat for research evaluation authorities.

The main reform made by the minister consisted in building up the missions of the General Directorate of Research and Technology; the latter now integrates a whole series of missions which used to be supervised by other directorates or delegations and which should thus achieve improved coordination.

Thus, "with the cooperation of high advisors appointed by order of the minister in charge of research, the directorate is responsible for the development and implementation of the research and technological development policy and, without prejudice to the functions of the minister in charge of industry, for all innovation incentive programs falling within its attributions. The directorate shall establish the necessary liaisons with the departments concerned in other ministries. It shall inform research evaluation authorities and obtain their opinion in order to define general orientations."

The directorate shall:

- orient and coordinate the activities of the departments it supervises;
- serve as liaison with the Higher Council on Research and Technology;
- supervise all bodies which come under the Ministry in charge of Research.

The Delegation to Innovation and Technology shall:

- prepare the scientific and technical content of research and technological development programs and be responsible for their management;
- study, at the scientific and technical level, the allocation of the corresponding incentive credits.

In liaison with the departments of the Ministry of Industry, the Delegation to Innovation and Technology shall:

- establish liaisons with businesses, as required to evaluate and follow up the research and development programs which they manage and for which they receive government credits, and to promote industrial research;
- be responsible for the implementation of the ministry's policy in the regions, in the fields of research, technological development and innovation; to this end it shall call on the regional directorates of industry and research;
- study, propose and implement means to promote the implementation and dissemination of the results of public research in businesses, in order to encourage the production of innovations;
- be responsible for the promotion of training through research in the industry;
- in liaison with the Ministry of Economy, Finance and Privatization, propose procedures and methods to finance public and private research without having

recourse to the state budget, and propose tax incentives for the development of research and innovation.

The mission of the Delegation to Scientific and Technical Information shall be:

1) To contribute to the promotion of scientific and technical culture in society.

To this end, the Delegation to Scientific and Technical Information shall:

- participate in the creation of scientific and technical culture centers, and see to the proper development of the policy of knowledge dissemination implemented by the bodies supervised by the Ministry in charge of Research;

- provide its support to the initiatives of local communities and to the life of associations in the scientific and technical fields;

- contribute, in the fields that fall within its province, to a publishing policy and to the realization of exhibitions and other events in France and abroad.

2) To coordinate the efforts made by the bodies supervised by the Ministry in charge of Research to produce, exchange and disseminate specialized information, and to implement the national scientific and technical information policy.

The Directorate of Research Financing shall:

- prepare budget decisions concerning the allocation of state credits to public institutions and research bodies, in the context of the civil research and technological development budget. In liaison with the Ministry in charge of the Budget, it shall be responsible for the drafting and implementation of finance laws as far as credits provided in the budget of the minister in charge of research are concerned. It shall investigate proposals concerning the appropriations and personnel provided under the budget. It shall distribute resources and control the use that is made of them. It shall coordinate relations with the Ministry in charge of Budget;

- be responsible for the preparation of information documents submitted to the parliament during the debate on research and technological development credits;

- be competent to consider the budget and financial problems of the board of directors of public institutions and research bodies supervised by the Ministry in charge of Research. It shall examine the annual reports of these institutions;

- be consulted on the allocation of credits under operating contracts and for international cooperation efforts;

- manage intervention and incentive credits;

- carry out studies on the cost, profitability and economic impact of research investments. It shall work out statistics concerning budget spending for research and development and collect accounting and financial data on program budgets;
- see to it that optimum use is made of available resources, and propose reforms for budget and financial procedures.

The director of research financing shall be assistant to the general director of research and technology.

The Department of Scientific Employment and Research Administration shall:

- be in charge of the scientific employment policy. It shall study the prospects for scientific employment in all public and private bodies and businesses; it shall propose general guidelines for scientific employment. It shall draft the measures to be taken concerning training, recruitment and mobility;
- prepare the statutes of research personnel and see to their implementation;
- prepare the structural reforms affecting public research and technological development bodies. It shall coordinate the policy adopted with respect to scientific and technical foundations and associations; it shall set up the legal structures required to promote cooperation among public research bodies and laboratories and between them and other public and private bodies;
- in liaison with the General Directorate of Higher Education and Research and with the other departments of the General Directorate of Research and Technology, it shall establish a policy of training for and through research. It shall be in charge of allocating research grants, and it shall follow up the policy of industrial agreements for training through research in businesses; it shall coordinate all programs of training through research for the ministry as a whole;
- be in charge of preparing the legislative texts and regulations falling within the province of the General Directorate of Research and Technology, and it shall be in charge of all legal matters.

The general secretariat of research evaluation authorities shall carry out all necessary investigations and assessments according to procedures defined by decree, or it shall have them carried out by others on behalf of these authorities.

Management Changes

Paris LE MONDE in French 23 Dec 86 p 19

[Article signed J.-F. A.: "Reorganization of the Research Ministry"]

[Text] The reorganization of the departments in charge of research at the Ministry of Research and Higher Education, which had been expected for several months and had been ready since the end of October, was just made public. The reform, initiated by the former minister of research, Mr Alain Devaquet, aims at replacing the present two-headed directorate of the ministry by a single directorate while also reducing its personnel.

Since the former General Delegation to Scientific and Technical Research (DGRST) was replaced, in 1981, by a full-fledged ministry, several reforms have been implemented in succession, modifying the missions of certain departments, adding new directorates, etc. Since 1982, however, research as a whole was managed by two major entities: the Scientific and Technical Mission, an evaluation and assessment body; and the General Directorate of Scientific and Technical Research, in charge of budget management and, therefore, wielding power.

Mr Devaquet chose a more traditional organization whose main component is "administrative" rather than "scientific." Indeed, from now on research will be managed only by the General Directorate of Research and Technology (DGRT), which has been headed by Mr Jacques Perget since last May. The DGRT will cap three delegations representing as many "operational departments":

- The Delegation to Research will take over some of the former tasks of the Scientific and Technical Mission and will be in charge of monitoring research bodies and "scientific promotion."
- The Delegation to Innovation and Technology (DIT) will be in charge of applied and industrial research and research promotion in businesses. As a result, it will monitor the policy implemented in the regions in matters of research, technology and innovation, in liaison with the regional directorates of industry and research. The DIT will be supervised by the Ministry of Research, which caused some rivalry with the Ministry of Industry, but an area of agreement was found and Mr Devaquet finally had his way.
- The Delegation to Scientific and Technical Information will fulfill the mission of the former directorate in charge of these problems (the DIXIT); however, it was said at the ministry, it will have to "refocus its efforts on scientific culture and specialized information."

In addition to these three delegations, which will be supervised by the DGRT and whose efforts will be coordinated by the Directorate of Research and Programs with the assistance of a survey and programming department, there will be a number of functional departments, also supervised by the DGRT: a Directorate of Financing and Research that will devote its efforts to budget preparation and resource management; a Department of International Relations; and an independent Department of Scientific Employment and Research Matters

and Administration, which will take over part of the activities of the Directorate of Research Organization and Promotion, which has now been abolished.

As for the Center for Projections and Evaluation and the Higher Council for Research and Technology, which operate aside from the administrative departments proper of the ministry, they should not be affected by the reform.

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

ITALIAN RESEARCH MINISTER, CNR DIRECTOR COMMENT ON NEW POLICIES

Granelli Notes Increased Financing

Milan BUSINESS in Italian No 11, Nov 86 pp 39-41

[Interview with Italian Minister of Scientific and Technological Research Luigi Granelli under the headline: "Granelli: Grant Me More Independence;" date and place not given]

[Text] He was supposed to be the minister in charge of the implementation of the reform, which has been awaited for 25 years, of the CNR [National Research Council], Italy's leading research center. But the ups and downs of political events never gave him the time and the wherewithal to do it. What he is left with is the satisfaction of being the virtual creator of that reform and the true reference point for men of science in this important stage of transition for national scientific research.

And yet Granelli, with his step-by-step approach, has succeeded in getting something done. After being in charge of a ministry with no budgetary independence for 3 years, he managed to "gnaw" at the different financial laws, which have succeeded each other from 1983 up to now, in order to obtain the long-sought funds required to develop a working program which might coordinate and give logical order to research efforts. This is demonstrated by the additional 1.5 trillion lire allocated by the 1987 financial law for industries engaged in innovation, as provided for under Law 46.

BUSINESS: Minister Granelli, let's start right from the CNR reform program.

Granelli: The reform of the research center must be viewed as a stage in a more far-reaching and overall process.

[Question] What do you mean exactly?

[Answer] I believe that the whole research system in Italy must be changed, or rather be brought into line with the models prevailing in the more advanced countries. I will submit the framework law concerning the activity of the CNR within the first half of 1987; this law is an essential step to establish an effective link between the "management" of research and the planning of domestic economic development.

[Question] And what about the "new" Ministry of Scientific Research?

[Answer] There is indeed a widespread need for a "new" ministry, as you just described it. Establishing a new ministry means ensuring budgetary independence and the actual ability to work out and implement a correct strategic policy for our research.

[Question] There are also talks about setting up a single ministry for university and scientific research on the French model. This would be a considerable achievement, wouldn't it?

[Answer] Yes it would, but on one condition, that is, that the research policy as a whole be updated. Otherwise, the ministry would prove a powerless and trivial institution.

[Question] We know that 1.5 trillion lire have already been allocated for the 3-year funding of Law 46. Is there any other news in terms of investments?

[Answer] The IMI fund is to allocate another 100 billion per year (for 10 years) for the qualitative improvement of industrial research (credit facilities) in addition to this initial sum. Furthermore, a 400 billion national program concerning "biotechnology" will be implemented by 1987 and another two programs are on the drawing board.

Rossi-Bernardi on 'Brain Drain'

Milan BUSINESS in Italian No 11, Nov 86 p 41

[Interview with CNR President Luigi Rossi-Bernardi under the headline: "Rossi-Bernardi: 50,000 New Jobs;" date and place not given]

[Text] The secret of Professor Luigi Rossi-Bernardi, president of Italy's leading research center, the CNR, is said to lie in frugal meals and hard work.

While one is initially misled by his lean and drawn appearance, one is immediately overwhelmed by the amazing amount of figures, data, and facts he quotes, which goes to show the efficiency and pragmatism of this man of action. In the course of his 2-year presidency, Rossi-Bernardi, an Emilian by birth, a Lombard by adoption, and an Anglo-Saxon by education, has succeeded in setting the CNR on its feet by "cataloging" and "regimenting" it through the use of data banks.

It is therefore possible to know the state of knowledge in our country at any given time--who is studying, surveying, and researching what in any field of human knowledge.

BUSINESS: What are the financial resources the CNR will be able to count on?

ROSSI-BERNARDI [The CNR will be able to count on] a 100 billion increase in the annual investment fund, which will enable the CNR to start working on ten

target-oriented programs of the "third generation" as soon as the latter are approved by the CIPE [Interministerial Committee for Economic Planning]. Investments of 720 billion lire are to be made over the next 5 years, an additional 300 billion being provided by enterprises. We must now invest in "brains."

[Question] What does this mean?

[Answer] Today, the most conspicuous factors limiting the development of our scientific system lie in the number of qualified researchers operating in sectors that are vital to the future of our country and in the lack of available research facilities. For this reason the CNR is approving a policy designed to centralize its 268 research bodies in 13 large areas throughout the country. This will offer the opportunity to optimize equipment and--most significantly--to promote contacts and exchanges between CNR and university researchers.

[Question] In your opinion, what are the goals to be attained to strengthen our scientific system?

[Answer] First, we should provide the government system with a Ministry of Research with actual powers of coordination and management of the sector. Furthermore, we should increase the number of young researchers and technicians by 50,000 over the next 5 years. This effort should be accompanied by an increase in expenditures for basic and applied research by concentrating resources in those sectors that are vital to the development of the country. Moreover, we should encourage a greater commitment on the part of industry and private citizens by providing incentives. Finally, we should take a direct hand in public research centers, by revising the existing expenditure regulations and providing research staff with new statutes and remuneration which might prove competitive in the domestic market. This is the only way to put an end to the brain-drain which has led some of the best researchers to choose universities over public research centers.

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

BMFT REITERATES GUIDELINES FOR PROJECT CONTRACTORS

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 441, 17 Oct 86
pp 3-4

[Excerpts] At the request of the Federal Ministry for Research and Technology [BMFT], a staff member of the Juelich nuclear research plant visited the Gerena firm in Berlin to clear up misunderstandings concerning a decision made on a Gerena research proposal.

The federal government pointed out the following concerning the role project contractors with the BMFT:

The main duty of project contractors, most of whom are involved with large-scale research facilities, is to take over scientific, technical, and administrative tasks within the framework of the project subsidy in order to relieve the BMFT of this responsibility. This includes, first of all, the technical and administrative processing of proposals. Project contractors have no advisory conclusions. Instead, they make promotion recommendations, taking expert opinions into account. The support decision, particularly the determination if and to whom subsidies are to be granted, as well as the decision as to which project should receive subsidy and in what amount, is left to the BMFT.

The basic agreement regulating cooperation between the BMFT and the respective project contractors requires them expressly (in paragraph 6) to avoid conflicts of interest and distortions of competition in relation to beneficiaries of grants. In practical terms, this condition is assured by the fact that decisions on project allocations for installations of project contractors are made without intervention of the contractors. Moreover, the latter must treat the acquired knowledge and experience as confidential, even toward their own R&D centers. Organizational measures guarantee that knowledge and experience acquired by the project contractors do not cause any competitive disadvantage for the supported grant recipients.

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

INDUSTRY MINISTER DETAILS RESTRUCTURING OF MINISTRY

Paris LE FIGARO in French 3 Dec 86 p 15

[Interview with Alain Madelin, minister of industry, postal services, telecommunications, and tourism, by Henri d'Armagnac, Elisabeth Chavelet, and Pierre Zapalski; date and place not given; first three paragraphs are LE FIGARO introduction]

[Text] In an interview with LE FIGARO, Minister Alain Madelin explained that the purpose in reforming the Ministry of Industry is to influence the environment and competitiveness of French firms.

The new structures will be based on markets rather than production, as they were before. One major department--the Department of Competitive Environment--has the basic mission of creating the conditions with respect to legislation, regulations, taxes, social matters, and international relations that will ensure better competitiveness on the part of the firms.

The reform of the ministry is one of modernity in the service of growth strategies with a view to the single European internal market that will begin in 1992.

Question: The Ministry of Industry in France is interventionist by tradition. Isn't it odd to find Alain Madelin, a liberal minister, at the head of a ministry that is not only interventionist but also destined to disappear?

Answer: I have never said that we should make the Ministry of Industry disappear. It must be transformed. The world is stirring. The firms have to take up a fantastic challenge. They must adapt to a new international environment which is forcing them even more than in the past to aim at the highest level of competitiveness. How can one ask them to make this permanent adaptation while continuing to confront them with a Ministry of Industry whose sluggish structures were inherited from 40 years of dirigisme? Like the firms, the Ministry of Industry must "adapt or perish," to use the title from Alvin Toffler's book.

Question: How is your organization going to adapt itself closely to the needs of the firms?

Answer: What we see in the world of today is the importance of knowledge. Knowledge and the transfer of knowledge are the principles inspiring all high-performance organizations. Those are the principles which have guided my actions. The first thing is to be familiar with what I call the competitive environment--that is, the space in which French firms move and that in which their competitors move--in order to see whether French structures are providing firms with the most favorable environment for competitiveness.

Transfer

The ministry must acquire the means for studying and influencing that which constitutes to a large extent the key factors in economic success. The second thing is to be familiar with the way occupations and markets are developing worldwide. The days are past when the frontiers of political sovereignty coincided with the frontiers of a firm's market. For many company heads, the horizon already includes the whole world, whether they are thinking of their suppliers, their raw materials, their patents, or their customers.

The ministry must be a center of information and services enabling the firms to situate themselves with respect to those markets. We must therefore gather information and then circulate it. Quite obviously, the chief beneficiaries of that transfer of knowledge will be the PME [small and medium-sized businesses], which in most cases are not in a position to gather that worldwide information themselves. One of the jobs assigned to our regional directorates will be that of making that transfer. I would like to say that I would also see nothing but advantages if the trade press could take advantage of the "data bank" which this ministry will be.

Question: Specifically, what is this going to change?

Answer: The ministry used to be divided into large vertical directorates. The new structures will now comprise three horizontal departments and four vertical departments, not including the regional directorates, of course.

The entire organization will be under the authority of the director general of industry, who is, as you know, Jacques Maisonneuve.

The big novelty among the horizontal departments is our establishment of the Department of Competitive Environment (SEC). Its main job will be that of creating the conditions with respect to legislation, regulations, taxes, social matters, and international relations that will ensure better competitiveness on the part of the firms.

Within that department, one subdirectorate will be responsible in particular for seeing to it that everything is ready for the European market, which, as you know, is scheduled to begin in 1992.

The ministry must help the firms prepare for that economic dimension.

Alongside the Department of Competitive Environment, we have two other horizontal departments: the Department of Regional Action, Security, and

Industrial Competitiveness and the Department of Innovation and Industrial and Technological Development. One purpose of those departments is to actuate the instruments available to the ministry for influencing the environment in which the firms operate: standards, patents, metrology, and so on. Another is to think up and implement horizontal measures: support for innovation, assistance for consultants, policies with respect to quality, training, and so on. In short, they will transfer to firms in general, but to the PME in particular, the ministry's knowledge in the areas of innovation, technology, processes, standards, and so on.

The vertical departments, of which there will be four, will be organized not on the basis of production, as before, but on the basis of markets.

Let us take an example: it used to be that the same directorate was in charge of refrigerators, cranes, and sheet steel because iron production was at the source of all three. But those are three very different markets. From now on, those products will be separated. The first will be handled by the Consumer Goods Department, the second by the Capital Goods Department, and the third by the Basic Industries Department.

Everyone is well aware that today, it is the market which rules. The structures of the Ministry of Industry had to adapt to the demands of that situation.

Modern Approach

Question: What are the profiles of the men destined to head up those new departments?

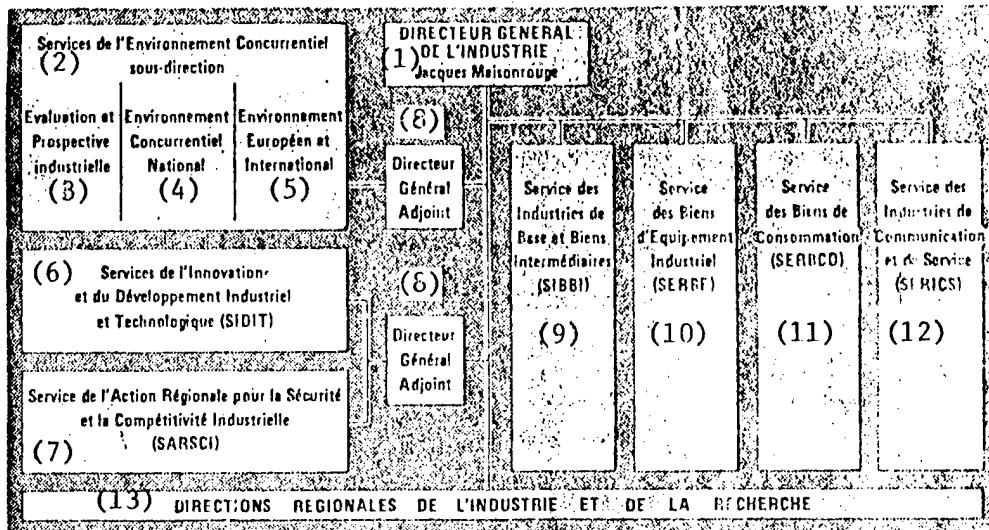
Answer: Not everyone can have a profile like that of Jacques Maisonneuve. In any case, we have men and women in our departments who are particularly competent and who are very familiar with the problems of the firms. They are in agreement with this reform and were hoping for it. I would like to manage this new arrangement as though it were a firm and introduce the idea of career planning. I want to establish a more modern approach with individual evaluations, introduce management by objectives, and reward effort by seeing to it that an individual's merit will be reflected in his or her remuneration. For the first time, this ministry will have an office of professional development that will manage the careers and training of the personnel.

In conclusion, I would like to say that the minister of industry has a sizable budget of a little over 34 billion francs. That is more money than Laurent Fabius had when he occupied this office and more than my predecessors before 1980 had. The problem is not that of saying "I spend, therefore I exist," but of using those funds according to a new method: the thing that counts most in a firm is gray matter, and anything that can be done to transfer intelligence is a step in the right direction. Something else that counts in any firm is the competitive environment, and anything we can do to improve that environment will affect the competitiveness of the firms. So with the money at my disposal, I must act better and more intelligently.

The Ministry of Industry has no call to turn in on itself. Certainly it must place its skills at the service of the government structure, but it must also uphold the cause of competitiveness in the firms over against the other ministries.

I firmly intend for us to be a place of excellence in matters of administration.

Organization Chart



Key:

1. Director general of industry: Jacques Maisonnouge
2. Departments of Competitive Environment
3. Subdirectorate for Evaluation and Industrial Forecasting
4. Subdirectorate of National Competitive Environment
5. Subdirectorate of European and International Environment
6. Departments of Innovation and Industrial and Technological Development (SIDIT)
7. Department of Regional Action for Security and Industrial Competitiveness (SARSCI)
8. Deputy director general
9. Department of Basic Industries and Intermediate Goods (SIBBI)
10. Department of Industrial Capital Goods (SERBE)
11. Department of Consumer Goods (SERBCO)
12. Department of Communication and Service Industries (SERICS)
13. Regional Directorates of Industry and Research

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

FINLAND IN FIVE NEW EUREKA PROJECTS

Helsinki HUFVUDSTADSBLADET in Swedish 16 Dec 86 pp 3, 11

[Article: "Finland in New Projects"]

[Text] Finland will join in five additional projects in the European high technology program Eureka. Four of these projects are totally new and one is already underway. The new projects will be announced on Tuesday at a ministers' meeting on Eureka in Stockholm. Finland is already involved in seven projects.

The Finnish companies that will now begin participating in the Eureka program are the Puimalainen Research Institute in Kuopio, Rauma-Repola's company Lokomec, and Partek. Already participating in Eureka are Nokia, Valmet, Vaisala, and Kone. Participating governmental institutions are the Environmental Affairs Ministry, the Education Ministry, the Meteorological Institute, and the Ocean Research Institute.

Plans for the Stockholm meeting include giving about 50 new projects so-called Eureka status.

The Finnish delegation to the meeting will be led by Trade and Industry Minister Seppo Lindblom (Social Democrat).

Eureka was founded 1.5 years ago at the initiative of French President Francois Mitterrand. Finland was invited to participate at the first conference of ministers in June 1985 in Paris. The goal of Eureka is to make Western Europe the world's third leading high technology center, after Japan and the United States. The 12 EC countries plus Finland, Sweden, Norway, Iceland, Austria, Switzerland, and Turkey are included in the program. Several countries in Eastern Europe have also expressed interest in participating, but so far no decision has been made concerning a possible increase in the number of member nations.

From the very beginning it has been suggested that Eureka is Europe's answer to the United States defense project SDI or "Star Wars." Finland has stated repeatedly that it would participate only in civilian projects.

Eureka is primarily a cooperative program for corporations, but delegates to the Stockholm meeting will discuss how various governments could support projects, for example by participating in the marketing of products that result from the projects.

Last fall the Trade and Industry Ministry changed its requirements for supporting product development so that support can now be granted to demanding, long-term international research and development projects to a greater extent than in the past.

This decision means that the government will increase its allocations by about 10 million markkas annually.

From Robots To Environmental Protection

At the meeting of ministers in Hannover just over 1 year ago, it was decided that the Eureka program would concentrate primarily on communications, robot technology, biotechnology, lasers, ocean technology, and environmental protection. One condition for including a project in the Eureka program is that at least two countries must participate in the project.

An office in Brussels makes available information on Eureka and material on the program. Every member nation also has a coordinator who serves as a liaison between companies in his country and those of other nations. The coordinator in Finland is Juhani Kuusi, director of the Technological Development Center, which is part of the Trade and Industry Ministry.

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

REPORT ON FINLAND'S POSITION IN R&D RACE

Helsinki HUVUDSTADSBLADET in Swedish 9 Dec 86 p 14

[Article by Erik Wahlstrom]

[Text] Finland is attempting to become oriented in the modern world, where a seldom-questioned assumption is that increased technological research and development (R&D) is a precondition for increased success on export markets.

Further, it is assumed that this success in the area of exports is necessary for the development of society and for the happiness of the people.

What is called a unique report on Finland's position in this competition has been published by Finland's Technical Society. The report was made public yesterday.

It was written by Otso Toikka, an engineering student. In the report, Toikka gives a quick overview of technological research in Finland and in several competing nations that were chosen so as to represent various types of competitors.

These other countries are Japan, West Germany, France, the Netherlands, Sweden, and Austria.

Joint Projects

A chapter on the various joint R&D projects in Western Europe are arranged according to various general topics: the spheres of EC cooperation in scientific and technological strategy and energy, including a large number of sub-projects, COST which is a joint European organization for cooperation in science and technology that was started in 1969 and is now being overshadowed by more recent projects, cooperation in space, CERN which is involved in particle research, Eureka's technological research, Nordforsk, and the Nordic Industrial Fund.

This annotated catalogue will certainly be of value for many years to come as a kind of European reference work. A 25-page catalogue of projects in Finnish R&D will probably be just as valuable.

Cause For Reflection

The final chapter, a comparison between Finland and the other countries, is the book's high point. It is also the chapter that is the greatest cause for reflection--which is its purpose.

It is namely so that Finland is not the only country that has discovered that R&D is necessary to compete for exports. In fact, all the countries that compete with Finland have discovered the same thing--and, what is more, they discovered it earlier than we did.

In addition, they have also discovered or decided for themselves that the same areas of technology, primarily biotechnology and information technology, will be the growth industries of the future. They, like Finland, are investing large sums of money precisely in these areas, both as a percentage of GNP and in absolute figures. Finland's absolute figures for R&D investments are extremely modest in comparison and must remain so, regardless of whatever relative investments we may make in R&D.

GNP Per Capita

So far, Finland has done well by not investing in R&D and, instead, channeling money into such things as theology, agriculture, music training, two national languages, etc. With this strategy, we have managed to achieve the same GNP per capita (\$10 to \$11 thousand in 1985) as the model countries West Germany, France, and Japan with their far greater R&D investments both in relative and, especially, in absolute figures.

Finland's 'low-tech' strategy is now believed to be outdated, even though it has demonstrated its practical effectiveness. The government's present goal is to invest 1.7 percent of Finland's GNP in R&D in 1987 and 2 percent in 1990. This means that appropriations for research in the national budget must increase by 10 percent in real figures each year.

Private Spending Increasing Most

Heikki Kotilainen, research director at Tekes (Technological Development Center), stated yesterday that, so far, most of the spending increases for R&D are coming from the private sector. These companies understand the importance of R&D better than the government.

What, then, should Finland's strategy be, since all its competitors have made an identical analysis of the situation?

"We must intentionally concentrate our investments in several narrow sectors where R&D investments are not worthwhile for the major research countries," he said. "We must develop superior know-how in our own little niches. The flexibility of a small country is one of our strongest assets."

Hopeless Competition

Kotilainen said that it was hopeless, for example, to try to compete with Japan in the area of entertainment electronics.

"It is a miracle that a single TV set is made in Finland today," he said.

"We are lagging behind the world's leading countries in microelectronics and we cannot afford to change this situation," Kotilainen said. "Basic research requires resources that we do not have. Finland's appropriations for research in all areas including the humanities and others are lower than the annual research budgets of many major corporations."

"Instead, our role in microelectronics must be to apply quickly and intelligently the latest results from the leading research countries."

High-Tech Paper

We can take paper production as an example, according to Kotilainen. "This is not defined as high technology in the international statistics, but extremely sophisticated computer technology is used in the control processes. In this area, we have applied foreign basic research in our own niche."

Kotilainen said that the R&D report from Finland's Technical Society was unique.

"It has no counterpart either in Finland or abroad," he said.

9336

CSO: 3698/176

WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

STU OF SWEDEN STRESSES COMPUTERS, MATERIALS IN 1987-90 R&D PLAN

Stockholm TEKNIK I TIDEN in Swedish No 4 1986 p 7

[Article: "Here is Where STU Will Invest More"]

[Text] STU (National Swedish Board for Technical Development) proposes increasing investments by 425 million kronor per year during the period from 1987 to 1990 to develop know-how and technology, as well as products that are important for Sweden in the international competition.

Several points in the proposal are discussed here by STU general director Professor Sigvard Tomner and IVA executive vice president Professor Hans G. Forsberg.

Tomner: In the area of information technology, the emphasis is on the development of know-how and technology, as well as product development. This is a broad region with considerable overlap that can be of benefit to other areas of technology.

We are proposing 100 million kronor for the category "Development of Know-How in Information Technology." This is what we believe the research system can use in the next few years. In the area of applications, the emphasis is on engineering mechanics.

We are recommending that "Long-Term Interdisciplinary Research" be given 30 million kronor. This is for what is called micronics: an interdisciplinary science involving electronics, mechanics, biology, chemistry, and physics. This is described in more detail in one of our publications: Interdisciplinary Science for the Future: Micronics Researchers (STU-information, No. 532-1986).

The recommendation also includes 35 million kronor for "Materials Science R&D." The emphasis here is on polymers and ceramics. Sweden's industrial position in these areas is good, but the situation is not so bright on the research side.

"Biotechnology" means basically the national biotechnology program, which is calling for additional investments of almost 300 million kronor over a 10-year period. STU's share of this figure is about 25 million kronor per year.

Forsberg: I have some doubts about this. I am a firm supporter of biotechnological research and development. We simply must not imagine that we, in biotechnology, can expect returns on industrial production in the near future, particularly in comparison with materials science technology, for example.

Tomner: "STUF" stands for STU's technical research council functions. We are recommending an additional 25 million kronor.

"Biomedical R&D" should get an additional 20 million kronor. This is based on the high-level research that is being conducted in this country. Medical research accounts for 40 percent of all research at universities and technical schools. As a result, it will receive more resources than the departments of technology in the natural sciences. At the same time, Sweden has a high-quality health care system. We have identified many projects in which STU can help with the right combination of high technology and complicated projects.

Another major area is "Environmental and Energy Technology." Here, STU has been asked specifically by the government to make spending recommendations.

Forsberg: Unfortunately, energy and the environment are not areas of great importance to the strength of Swedish industry. With all due respect to what STU is doing in these areas, it is completely out of proportion, considering the sacrifices that are being made in other sectors.

Tomner: That is true if we only look at the proposals from the standpoint of industrial policy. But we see investments in energy and the environment as something more than a contribution to industrial policy.

In order to carry out our proposals in environmental technology, we will need an additional 50 million kronor. The 30 million more for energy technology is a result of proposals from the Energy Research Study. The emphasis is on developing know-how and technology.

The government has also asked us to turn our attention toward "Regional Innovation Policy." We are recommending 45 million kronor for regionally motivated R&D investments.

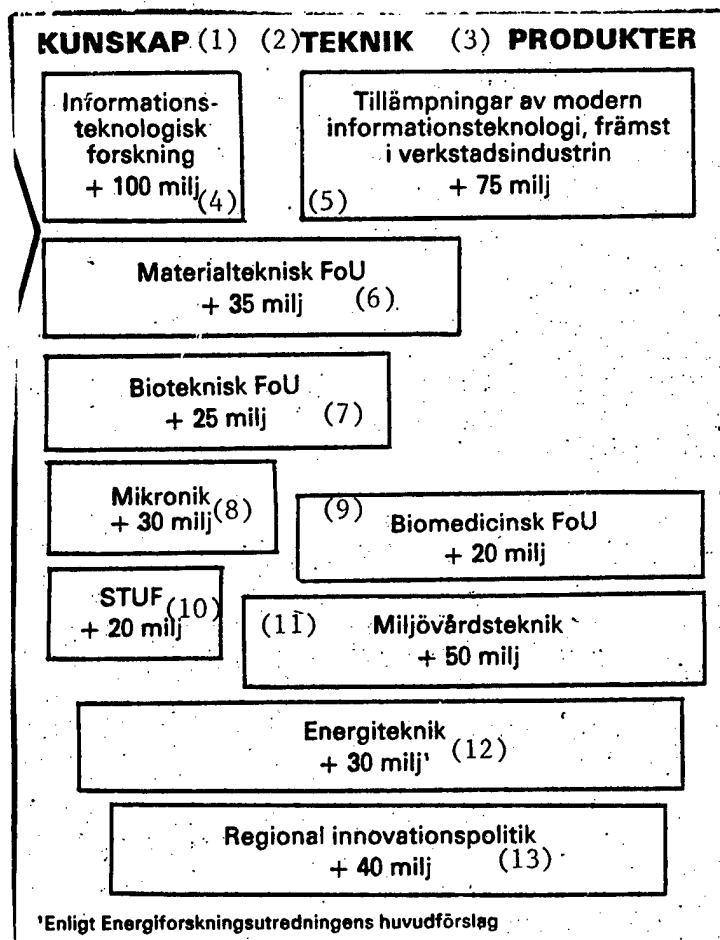
Footnote: The publications mentioned above have the following titles:

Interdisciplinary Science for the Future: Micronics Researchers
(STU-information No. 532-1986);

Interdisciplinary Science for the Future: Algorithm and Processor
Researchers (STU-information No. 533-1986);

Interdisciplinary Science for the Future: Expert-Based Control Systems Researchers (STU-information No. 534-1986;

Interdisciplinary Science for the Future: Humanities and Social Science Researchers as a Resource for Technical Development (STU-information No. 535-1986).



Outline of STU proposal for increased investments and increased average annual needs.

Key:

- | | |
|--|---|
| 1. Know-how | 6. Materials science R&D |
| 2. Technology | 7. Biotechnology R&D |
| 3. Products | 8. Micronics |
| 4. Information technology research | 9. Biomedical R&D |
| 5. Applications for modern information technology, especially in engineering mechanics | 10. STUF |
| | 11. Environmental protection technology |
| | 12. Energy technology |
| | 13. Regional innovation policy |

¹According to the main proposal made by the Energy Research Study.

WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

EEC COMETT PROGRAM TO ESTABLISH UNIVERSITY-INDUSTRY COOPERATION NETWORK

Brussels INDUSTRIE MAGAZINE in French Nov 86 p 3

[Editorial signed INT: "European Industrialists: It Is Your Turn"]

[Text] Industrialists, the ball is in your court. Or, to be more precise, it will be there in a few months, in early 1987, when the European Commission launches its COMETT [Community Program for Education and Teaching in the Field of Technology] project for university-industry cooperation in training qualified specialists in advanced technologies.

The Three-year (1987-1989); 45 million ECU (more than 2 billion Belgian francs) COMETT project arose from some worrisome observations: European industry is experiencing increasing difficulty in finding the specialists it needs to remain internationally competitive. If Europe wants to answer the hi-tech challenge from Japan and the United States, it must institute a dynamic policy of investment in development of its human resources.

Specifically, the project will develop a European network of university-company associations, establish student-employee exchange programs between universities and companies, develop and experiment in joint university-company continuing education projects, and introduce multinational initiatives for the development of multimedia training systems.

In mid-November, the COMETT Committee should decide on the specific means of implementing the Commission's decision to create the COMETT project.

We will then know the specifics of university-company exchanges, that is, the sending of students (and teachers) into companies, services, organizations, etc., and the sending of business and industrial managers to universities, training centers, etc. It should be noted that the exchanges must be European, meaning that a student from one country must serve his COMETT internship in a company within another European country, and vice versa.

Even before implementation processes have been determined, European universities have expressed great interest in the possibilities offered by COMETT, flooding the European Commission with applications and requests for information. But manufacturers have been more reticent, perhaps waiting to learn more about the program which will be made available to them.

It will be up to them to accept the challenge offered them. Remember: The ball will be in their court as of early next year.

WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

BRIEFS

ITALIAN ARTIFICIAL INTELLIGENCE R&D--The Autonomous Province of Trento's IRST [Scientific and Technological Research Institute] has launched a 5-year 1986-1990 program involving a financial commitment of some 60 billion lire between investments and operating expenses. More than half these funds will be used for research in the field of artificial intelligence, one of the IRST's two areas of interest. The IRST has been headed for several months now by Luigi Stringa, the former managing director of Selenia. The kind of approach the IRST has adopted is aimed at producing know-how that is directly transferable to the industrial sector; hence, an organizational and operational approach more along the lines of a private-sector business enterprise than of a public-sector research institute. In particular, constant attention will be paid to the cost-vs-effectiveness of the various projects as an important parameter in the evaluation of programs to be funded and subsequently transferred to industry. The IRST's initial objective is to develop small-scale expert systems, an undertaking that, together with the other objectives on its agenda, could even attract the return to Italy of researchers who have emigrated to the United States. [Text] [Milan AUTOMAZIONE E STRUMENTAZIONE in Italian Jan 86 p 98] 9238/6091

CSO: 3698/92

WEST EUROPE/TECHNOLOGY TRANSFER

TII AIDS DATA EXCHANGE, TECHNOLOGY TRANSFER WITHIN EC

Luxembourg LUXEMBURGER WORT in German 17 Nov 86 p 15

[Text] To stimulate innovation, to promote transnational technology transfer and, in general, to assist small and medium-sized businesses, as well as to take advantage of the existence of the Common Market: these are the goals of the TII a.s.b.l. - Association Europeenne pour le Transfert des Technologies, de l'Innovation et de l'Information Industrielles [European Association for the Transfer of Technology, Innovation and Industrial Information].

The origin of this non-profit association, headquartered in Luxembourg*, can be traced to a conference of the XIII General Directorate of the EEC Commission held in May 1982.

This conference provided the impetus for establishing an office for promoting innovation and technology transfer.

TII--a private corporation under Luxembourg law--was actually founded as a part of the 3-year plan for supporting innovation and technology transfer, SPRINT (Strategic Program for Innovation and Technology Transfer), which was adopted by the EEC Council of Ministers on 25 November 1983. The SPRINT program, which expires at the end of this year but is to be extended for another two, was allocated a budget of 10 million ECUs for fulfilling its tasks; a part of this budget was used to establish TII.

When TII was first established in 1984, 75 interested parties were involved. Today, that number has increased to 200. And, according to the technical director of TII, Michel Duhamel, a membership of 500 is projected for 1989.

The roster of members, who also make up the customer base of the association, reflects TII's objective of bringing together in a type of union all organizations involved in innovation and technology transfer: innovation

*TII a.s.b.l.

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consultants, marketing and management specialists, experts in the area of operating a business, etc. TII estimates that in the 12 EEC countries, there are approximately 800 private, governmental, and semi-governmental organizations directly involved in technology transfer. In addition, there are some 4,000 organizations involved on a related basis, e.g., banks seeking investment opportunities, universities and laboratories with special know-how, regional development agencies, data banks, publishers of scientific journals, and industry and trade organizations.

The main activity of TII is to promote exchange of information between its members as well as cooperation between all carriers of industrial information. The objective here is twofold. On the one hand, it is to assist small and medium-sized businesses in coming up with innovations themselves, acquiring new know-how and diversifying their activities, and, on the other hand, to assist them in marketing their own know-how by selling licenses to partners in other countries.

With the financial support of the EEC Commission, TII has so far held five international seminars, conducted eight visits of technology centers, organized the non-restrictive exchange of experts in the area of technology transfer, and supported task groups on special topics. TII publishes a "Newsletter" for its members and is currently preparing the third edition of its membership register "Who is Who in TII." A new activity TII would like to initiate is group visits to technology exhibitions such as the Flanders Technology Exhibition, the Hannover Exhibition or the Paris Innova. The purpose of this program would be for attending experts from industry and trade to take substantial advantage of the exhibition visits.

In the course of its work, TII has discovered there is still a great need for training in the area of technology transfer. As a result, plans have also been laid for holding in the years ahead seminars regarding work methods in this area.

Finally, TII also cultivates relationships with related organizations such as the European Business and Innovation Centre Network (EBN) in Brussels, the Technologie-Vermittlungs-Agentur (TVA) [Technology Exchange Agency] in Berlin, or the European Venture Capital Association (EVCA).

TII Wishes to be financially independent of the EEC Commission by 1989 and to finance its overhead costs by means of its membership fees. At 150 ECUs per member, these fees are relatively low in comparison with other organizations such as EBN and TVA (2,000 ECUs/member). However, the administrative council of the association is planning to replace the policy of a standard fee with one based on the size of the individual member organization.

To become a member, an interested party simply submits an application to the administrative council, which then decides whether the party is to be accepted. Geographically, membership is restricted to persons and organizations from the 21 states in the European Council. Currently, approximately 95 percent of TII members are from the EEC.

WEST EUROPE/TECHNOLOGY TRANSFER

BRIEFS

FINNISH FIRM BUYS UK MARINE TECH FIRM--Rauma-Repola has purchased a controlling interest in the British maritime technology firm Osel-Group Ltd which produces, among other things, remote-controlled probes and one-man submarines. The company is located in Great Yarmouth in southeastern England. Last year Osel-Group had 15-month total sales of 48 million markkas. The firm has 55 employees. Rauma-Repola has also purchased all the stock in the engineering firm Malmari & Winberg of Helsinki. This firm has nine employees and specializes in designing maritime and submarine equipment. [Text] [Helsinki HUFVUDSTADSBLADET in Swedish 18 Dec 86 p 14] 9336

CSO: 3698/176

EXPERIENCES GAINED IN ROBOTIZATION OF POLISH PLANTS

Warsaw PRZEGLAD MECHANICZNY in Polish No 7, Apr 86 pp 3-5

[Article by Marian Rak, MSc (eng), chief forecasting, research and development expert, Enterprises of Industrial Automatics MERA-ZAP at Ostrow Wielkopolski: "Is It Worthwhile to Introduce Industrial Robots? (A Subject for Debate): An Analysis of Experiences of a Polish Factory With Manufacturing and Operation of Robots"]

[Text] Over the past two years robots and robotization again became popular subjects among Polish journalists writing about technological progress. The message of these publications was clear. It was emphasized how rapidly robots are being introduced in industrially developed countries, how many companies in the world are already producing robots, what magnificent technological solutions they present and what effects are obtained with robots. The inevitable conclusion all this suggested was that, again, for the umpteenth time, Poland had fallen behind.

The first attempts at formulating new programs of robotization in late 1984, however, were not preceded by any thorough analysis of the situation with robots in Poland that would take stock of the preceding experience and the attitude of Polish industry on this matter. When one wants to achieve progress in any field it is essential to know where one wants to begin and at what point down the road there will be a change and when one should go faster or slower.

Robots are a subject well familiar to Polish specialists for more than 10 years. By the beginning of the 1980's, however, it had disappeared from the spotlight. In 1983 there were tentative efforts to make a realistic assessment of the situation. It was at that time that Waldemar Siwiński published a factual and objective article titled "People Against Robots" (POLITYKA No 42, 1983). Currently, it is important to maintain this tone of businesslike realism in order not to fall again into frivolous optimism. One cannot simply proceed from the premise that if robots are being introduced elsewhere in the world we, too, must take this as inevitable and that if others have come to this we, too, will "somehow" arrive there.

Those who, without any doubt, seek to implement this "somehow" should be reminded of the reproach phrased 100 years ago: "You are the parrot of the

nations." And, yet, the "somehow" remains our operating procedure. We are not inclined to acknowledge even to ourselves that even ambitious programs of top importance are still being carried out with this "somehow" method. We are reluctant to listen to those urging to increase knowledge and especially where conclusions have to be drawn after hard work.

We do not like to write with objectiveness about the matters on which we are unsuccessful, which cause us trouble. When there are negative articles they are written in a tone of alarm, blame or panic, which never does any good by discouraging those who are experiencing difficulties but eventually could achieve positive effects in a different way. Quite often, the only way to progress is the costly practice of learning from one's own mistakes.

The facts and experiences reported in this article may comprise a minor episode, but they are real. They concern the development of two kinds of experiences at the same industrial enterprise:

--with introduction and operation of simple and complicated industrial robots; and

--with launching the manufacturing of simple industrial robots.

After so many years it is hard to tell what the motives were for launching these two kinds of experience. It is almost unimportant now, whether the reason was pressure from above, which is possible, or any other rationale.

Introduction and Operation

In the latter half of the 1970's the Enterprises of Industrial Automatics MERA-ZAP developed five uses for simple industrial robots PR-02 and two complicated robots IRb-60 (under license) and introduced them into operation at worksites. Currently, only one IRb-60 robot and one worksite with simple PR-02 are operational.

The simple PR-02 robots were installed in the following processes:

--for cutting from tape metal sheets used to build support elements of instrument cabinets. The process was performed on an eccentric press KD-2128 with a tape straightener-feeder and the following PR-02 modules: two modules of line movement, one module of local movements and two grip modules, plus a control-computer device. This was the more interesting industrial application of a robot;

--for installing and removing workpieces from the turret lathe DRT. In this case there were two modules each for line and area movements and one grip module. The system also had control unit PR-02/SD;

--for cutting a component from a sheet metal belt on PE-63 press using a feed tray and two modules--for line and grip movements--as the feeding and removing device, as well as a control chamber;

--for cutting pins out of a tape (cutting and separating in several steps) on PE-63 press with the use of a straightener-feeder and PR-02 modules: two for linear movements, one grip and a control unit; and

--for cutting screwdriver grooves in bolt heads on a machine designed at the factory with the use of line and grip PR-02 robot modules.

These applications did not utilize the more complicated robot modules: the rotational module and the module of linear horizontal movement associated with it. When these modules are used in a system the PR-02 robot comes close to complicated robots, but without them the composition of the modules resembles, rather, a manipulator set. PR-02 robots with these modules, however, have been installed at other plants, e.g., at Manufacturing Enterprises of Precision Equipment MERA-PAFAL in Swidnica (to service a worksite consisting of an automaton for cutting and widening pipes combined with a press), at Mechanized Enterprises of Household Appliances POLAR in Wroclaw (to operate two automated drilling machines) and at Economy Motorcar Factory at Bielsko-Biala (at casting preparation worksite in an automatic production line). It is unknown, however, whether these robots are still operational there.

In addition to the above-mentioned five simple robots, MERA-ZAP employed two large complicated IRb-60 robots. They were manufactured or, more exactly, assembled at Experimental Plant PIAP in Warsaw from components and assemblies supplied under license in a cooperative project by the firm ASEA (Sweden). The robots were used in the following processes: the first robot was used for polishing gas pump covers at a worksite composed of IRb-60 robot, the polishing plate on a stand, two cheekpieces, a special grip with a clutch element (used by the robot) and robot control unit; the other robot was used to sand cast workpieces and other elements with a large surface requiring a cleaning treatment.

Currently, only one simple PR-02 robot is still in operation at MERA-ZAP; all the others have been disassembled and--with proper conservation--sent to the warehouse. The reasons included, among other things, difficult and labor-consuming readjustment of worksites caused by such factors as failure to receive on time shaped steel sheet or tape of the appropriate size, as well as the need to use these machines for fabricating other components from different materials. Each time it was necessary to reprogram the applications or to reconstruct and reset the basic machine and in most cases even to design and build a new one. With mostly small batches processed on high-productivity machines and due to the fact that the design of PR-02 robots was not adapted for rapid assembly and disassembly (without impairing their precision and subtle design), these robot applications were not welcomed by machine operators.

Another reason was the limited processing capacity of the tool workshop. The prevailing mentality, dating back to the late 1970's, results in a predominant employment of workers engaged in immediate production. This hampers effective development of technological progress and the resulting productivity growth. Besides, the factories were not thinking about

preparing robotized production on a large-batch scale, but were planning for medium- and small-batch operations. If in this case one has a high-productivity machine one cannot afford to spend too much time on preparatory operation, keeping the machine idle while the robot control is being re-programmed.

At factories with mass-scale production of articles such as cars, tractors, washing machines, electric motors, etc., where steady and long-term production flows are handled, assembly processes turned out to be even less susceptible to robotization. For example, at MERA-ZAP the PR-02 robot in the most elementary form is used only on a specialized equipment, because no other functions can be performed on it (in addition, this worksite was created for reasons contradicting the economic principles, because there was a shortage of standard components in the market).

The situation with complicated IRb robots was somewhat different. The polishing of gas pump covers is a difficult and tedious operation, and after the IRb-60 robot was introduced more pump covers could be polished. As a result, the factory takes good care of this robot, probably better than of any other piece of equipment. Every malfunction or instance of downtime is treated as an emergency. Despite the large number of pump covers processed by the robot, its capacity utilization, however, is still low.

The other IRb-60 robot, however, has been taken out of operation, because it was too sensitive to work in a dusty room and was not properly maintained. The robot was sold to a different factory, which was capable of overhauling it and maintaining it in proper functional condition.

Introduction of Simple PR-02 Robots Into Production

Industrial Automatics Enterprises MERA-ZAP prepared itself for manufacture of PR-02 robots quite thoroughly, even though there were many difficulties at the launching stage, which is normal for any new product, especially one with precise engineering parameters and new technological problems. The factory developed the complement of accessories, published a catalogue of configurations of PR-02 robots and an even larger catalogue of PR-02 robot applications, which can be used as a handbook for the designer and has a bibliography of 30 references. The production was brought up to the stage of trial series and experimental series. The new products included nine modules for linear manipulation movements, four rotation modules, two grip driving modules and the control unit placed in a cabinet with manipulation board. In addition, a large number of application documents were prepared, many of which, unfortunately, were never put to use.

Considering the current price level, the amounts out of the Fund for Technological Progress spent on introduction of these products (totaling 7.5 million zlotys) plus operating expenses (just above 1 million zlotys) seem disproportionately low compared with the scope of work. Yet, the level of losses (amounting to almost 26.5 million zlotys, in 1982 prices) is quite disconcerting to the factory staff. Where did these losses come from? They simply resulted from the failure to sell products. The number of manipulator

modules (not counting those which were sold and put to use in the above-listed 30 applications) rose to 56 units. The inventory in stock rose to a few hundred modules and 45 control units.

All these products are in good condition and currently (with proper adjustment) can still be put to use, realizing part of their value. It should be borne in mind, however, that the most valuable functional rotation modules and the horizontal movement module operating with them were unreliable.

These troubles and losses caused disaffection among the staff. After three years they subsided, and now the staff is willing to resume the production, but only of the control component. The mechanical components, even the assemblies made under license for IRb robots, have not achieved such acceptance. This is a result of awareness of the technological difficulties and, particularly, the poor quality of our casting processes. Light, precise, rigid and stable castings are essential for making these robots (the simple robots were easier to make, because they were not manufactured with cast components).

Conclusions

The main conclusion that robots should be installed primarily where large series of products are made is obvious. The rationale for this has been explained earlier (BIULETYN MERA, June 1981), but from these arguments and other observations further conclusions can be drawn.

Exceedingly frequent resetting of the equipment, even though the program to be executed in the control unit can be changed easily (this refers also to simple PR-02 robots), takes too much time. This affects the need for precise setting of all the elements at a worksite, not just the robot. While this is done, the equipment remains idle. The accessories necessary for readjustment are expensive, they are underutilized and they have to be stored and maintained with special care, which is expensive. An additional difficulty is the absence of standard support equipment available on the market, such as various tools. This increases the amount of preparatory work, including the preparation of documents.

The robotization efforts at MERA-ZAP Enterprises until now required the following amounts of effort (working hours):

--project of application and programming	800
--execution of the equipment	700
--installation work	200
--starting a worksite	400

The number of hours may be less important here than their ratios, which show that manual work relates to intellectual work as 3:4.

The introduction of robots is associated with problems. The preparation quality of semifinished products has to be improved. There is a need for a quantitative growth of design projects and development of special equipment

without which a robot cannot be used. Highly skilled service is necessary. When the design does not provide for robot operation in dusty, moist and corrosive conditions or for stability to vibration and other disruptions, the worksite for a robot has to be made with the same requirements as one for humans. Robots adapted for hard conditions are heavier, difficult to service and maintain and less universal, so that retooling or putting them to different uses may be impossible.

Does this mean that robot applications in Polish industry were completely unjustified? At the moment, the answer is unclear. In our conditions the problem of robotization ought to be viewed from other standpoints and not from merely economical considerations, which are paramount in the developed nations.

For one thing, robots must replace man in those industrial processes where technologies and equipment present life and health hazard. Special versions of robots should be used in such situations: anticorrosive, antiseismic and resistant to all kinds of noxious fields with a high degree (class) of radiation protection, resistant to extreme environmental temperature and work which is physically or mentally exhausting because of its tediousness or the strenuous effort involved.

Secondly, robots are always justified where there is a labor shortage. The main argument of opponents of robotization based on depreciation estimates, which compare the high cost of robots with low wages, particularly in Poland, then becomes meaningless. Robots offer a chance of resolving the bottlenecks and the possibility of servicing the jobs that are shunned. We should have no illusions. In the current conditions we will find no human operators to do these jobs. One has only to look at the lists and statistics from employment departments and compare the number of job seekers (even not considering what kind of jobs they are looking for) with the number of openings (here one must consider the kinds of work that is offered in industry). Propaganda efforts have not helped, nor has the Fund for Vocational Activation been useful. Even the fact that workers' jobs pay more (especially in direct, particularly contract-based, production work requiring no major effort or high qualification) than jobs where higher education is needed did not change the situation.

Despite all the condemnation and derision aimed at absurdly overexpanded bureaucracy and management staff, these people were never moved into production. In addition, we must remember that industry exports not only its products but on a large scale also skilled labor and often its best specialists. This kind of export has a tendency to grow. This means that only robotization can improve the situation in the industry.

Thirdly, the economic aspects should also be considered, although in a wider sense which goes beyond the ordinary cost-effectiveness. In the above-cited BIULETYN MERA it was mentioned that a clear formula should be derived for defining the effectiveness of robotization, which, in addition to direct effects (due to savings of human labor, increased productivity of worksites and changes in production costs as a result of improved quality), should

also include secondary economic benefits which had not been previously computed and which are due to elimination of:

--costs of overtime payments. A robot can work three shifts or only the third shift, when electricity is cheap and it may be even more profitable to utilize it rather than stop the power generator;

--the costs of salary increments for work in health-hazardous conditions. A robot can withstand such conditions; and

--social costs, including the cost of air conditioning.

With such calculations the time of cost recovery for a robot can be reduced, and, respectively, its cost as compared with human labor will be lower. The economic effectiveness can be computed as $D = E_i/P_i$, where D is the cost recovery time, E_i is the total expenses of implementing a robotization project and P_i is the total annual economic benefits; it is necessary to develop the factor P_i factoring into it all the partial effects. In addition, as more experience is gained and the number of robots installed at factories increases the general robotization costs will decline.

The problem of robotization includes an additional aspect of technological thinking. It is required that a robot be adapted to the existing machines and equipment. If such a requirement is unattainable, a robot application to the worksite concerned is viewed as difficult and expensive. In actual fact, however, universal robotization calls for adapting machines and equipment to be operated by robots. If we assume that robotization is inevitable, it makes sense even now to proceed from this assumption in developing each new design or at least to consider such possibilities and act in accordance with the conclusions. This will be conducive to stepping up the robotization efforts, eventually avoiding many of the costs.

I remember vividly the early days of my professional career, which occurred at a time when automation was first introduced into our industry. Fierce battles had to be fought with project engineers and even more with equipment designers to compel them to take into account the needs of automation. For automation to be utilized in the optimum way, entirely different characteristics and solutions must be used in the design of automated machines and equipment. With the existing solutions automatic control was either impossible or could not give better results than manual control. The opponents of automation were happy to declare that man could not be replaced by machines, although this was not the goal of the effort. The purpose of automation was to relieve man and help him. A robot is also an automaton, although of a somewhat different kind.

Robotization is actually the problem of the future of the machine industry and manufacturing technologies. Other industries which use continuous processes had to automate themselves long ago. The factories manufacturing machines, equipment and products can pass--although not necessarily--through the following stages in their development:

--mechanization of technological processes (a necessary initial condition for the subsequent stages);

--computerization of control;
--robotization of worksites presenting a life or health hazard to human operators or avoided by workers or economically justified; and
--automation of production.

We will leave to sociologists the issue associated with the fear that is voiced sometimes to the effect that automation and robotization eventually will squeeze man out of the job market. Sociologists must do their homework and develop reliable forecasts. Maybe what awaits man in the future is not a lack of jobs but merely a change of occupation. An active individual with a responsible attitude to his duties will always find a meaningful and useful occupation. The lazy will not be helped even by perfect robots: They will always remain idle drones however perfect an image they might project.

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EAST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

GDR SPECIALISTS CONFER ON SCIENTIFIC EQUIPMENT

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[Interview with Prof Dr Gerhard Zscherpe, rector of the Mittweida Engineering Advanced School, Prof Dr Norbert Langhoff, director of the Center for Scientific Instrumentation of the Academy of Sciences of the GDR, and Prof Dr Dietrich Unangst, prorector for natural sciences and technology of the Friedrich Schiller University in Jena and chairman of the Council for Research Technique, Scientific Instrumentation, and Research Technology in the Ministry for Advanced-School and Specialist-School Affairs, by Doc Dr Joachim Laemmel, chief of the Coordinating Office for Scientific Instrumentation, and Engineer Lutz Hoedtke of the Mittweida Engineering Advanced School at the Second Scientific Instrumentation Conference held 2-4 September 1986 at the Mittweida Engineering Advanced School: "Technology for Scientific Instrumentation"]

[Text] The Second Scientific Instrumentation Conference is taking place between 2 and 4 September 1986 at the Mittweida Engineering Advanced School under the general chairmanship of that institution's rector, Prof Dr Zscherpe. This event is being conducted jointly by the Academy of Sciences by the Ministry for Advanced-School and Specialist-School Affairs (MHF). Organization is in the hands of the Scientific Instrumentation Coordinating Office of the MFH at the Mittweida Engineering Advanced School. At the first conference in 1984 the foreground had been occupied by scientific instrumentation in research. At the second conference the emphasis is upon scientific instrumentation in technology. Additionally, posters are being used to introduce system-solutions in scientific instrumentation and round-table discussions touch upon such themes as connections with education and continued education, modularization in scientific instrumentation design, et al.

On the occasion of this conference some questions are answered here for our readers by representatives of the agencies (AdW, AdL, MFH) which constitute the Coordinating Council for Scientific Instrumentation. Participants in this conversation were the rector of the host institution the Mittweida Engineering Advanced School, Prof Gerhard Zscherpe, the director of the Center for Scientific Instrumentation of the Academy of Sciences of the GDR, Prof Dr Norbert Langhoff, and the prorector for natural sciences and technology of the Friedrich Schiller University in Jena and chairman of the Council for Research Technique, Scientific Instrumentation, and Research Technology in the Ministry for Advanced-School and Specialist-School Affairs, Prof Dr Dietrich Unangst.

[Question] Sir, you are for the second time hosting this conference on scientific instrumentation. What are your expectations for this meeting?

Prof Zscherpe: To an increasing degree the institutions of the AdW, of the advanced schools, and of the AdL are confronted by the task of placing the major achievements of research at the disposal of our national economy. Scientific equipment capable of meeting the up-to-date requirements of scientists are an essential prerequisite for research at the highest level. The interdisciplinary problems created by this task in the area of scientific instrumentation have their specific features and are not taken into account comprehensively at other conferences. In order to cope with this great variety in the whole range from the development and manufacture of scientific equipment up to problems of education and continued education in scientific instrument design, a great variety of themes reflecting the whole breadth of the spectrum are dealt with in the plenary lectures, the short lectures in the various congress groups, in poster events, and in round-table conversations. The focal point of joint discussion in the various congress groups will this year be in those technologies whose availability and further development are an important prerequisite for the production of a modern research technique. For my part, I hope that this conference will furnish important impulses toward the use of technological resources in scientific instrumentation. This will have the effect of substantially strengthening the links between the partners in the AdW, AdL, and MfH on the one hand and between research scientists and the area of scientific instrument design on the other hand.

The resulting increase in efficiency on the part of all participants will yield research results for the national economy.

[Question] The 11th party congress has made great demands on science and technology and the further training of highly qualified cadres. Prof Unangst, what tasks must scientific instrumentation accomplish in this connection?

Prof Unangst: Modern scientific instruments and research technologies immediately become pioneering path-breakers for new means of production and industrial technologies. Thus scientific instrument design is faced with the task of making an immediate contribution to the realization of our economic strategy through the development, construction, and testing of scientific devices and equipment. During this process the development of scientific instruments and software is more and more becoming an integrated and organic constituent of research work. A technique of measurement and testing capable of meeting the highest requirements which makes use of the multitudinous possibilities of computer science and which opens up new and progressive research technologies has become an indispensable prerequisite to progressive research.

[Question] What does that mean for the advanced schools?

Prof Unangst: Scientific instrumentation in the advanced school area is directly linked to the education and training of our students. Here it is both a question of providing efficient and modern equipment and apparatus for qualified training of students and also a question of involving the students themselves in the development and production of new scientific equipment.

[Question] The development of a modern research technique is an essential task of the AdW. Prof Langhoff, as director of the Center for Scientific Instrumentation of the academy what routes do you see toward accomplishment of this important task?

Prof Langhoff: The attainment of important positions in decisive areas of science and technology requires both a forward-looking fundamental research concentrating upon those innovative areas of science and key technologies which are presently recognizable and also a perfecting of the material-technical basis of science with special emphasis upon research technique.

There are, in particular, two reasons for the fact that research technique has an ever greater influence upon the development of science and upon the results of science which are economically exploitable for the national economy:

1. Decisive breakthroughs on the scientific knowledge front are always associated with basic innovations in equipment technology, with new highly efficient primary discoveries in research technique. Today our interest is especially in research technique which creates new conditions for experimental observation and testing (e.g., for extreme physical states such as ultrahigh vacuum, plasma technique, cryogenic technique, et al.). In other words we are concerned here with new types of technological special equipment--not commercially available--required for the analysis, surveillance, and optimization of continuous processes. Most of the significant experiments being planned today in the natural sciences would be impaired if they were compelled to limit themselves to the research technology and technique which existed (only!) 10 years ago.
2. Research technique has an ever more intensifying effect upon the research work itself. A primary route in this direction consists inter alia in the consistent utilization of new computer technologies, the introduction of computer support for jobs in the area of development and design, but also to an increasing degree in theoretical fundamental research and in the further automation of scientific experiments. Through this link with the computer one gains a decisive saving of time and at the same time one achieves access to new areas of knowledge.

[Question] What conclusions have thus far been drawn from these demands?

Prof Langhoff: As early as the beginning of the seventies fundamental decisions have been made to encourage the further expansion of this independent scientific-technical discipline called scientific instrument design. These fundamental decisions have been based upon the two reasons given above and also upon the view that scientific instrument design is both a result of and a prerequisite for the research process and exercises a decisive catalytic effect upon acceleration of scientific-technical progress.

Toward this end this discipline concentrates its efforts primarily upon:

- i. employment of about 20 percent of the staff of the AdW to assure a production volume in scientific instrumentation amounting to about 100 million marks;

- ii. strengthening of research having an instrumentation emphasis in its methodology as well as strengthening of specialized areas (centers emphasizing diagnostic methodology, central analytic laboratories, et al.);
- iii. expansion of institute shops into efficient structural units for instrument manufacture;
- iv. creation of centralized instrument production facilities in larger research organizations or in scientific bottleneck areas.

[Question] In the scientific instrument design of the AdW there is arising a very valuable research technique. Prof Langhoff, what method of working and what results characterize the profile of the Center for Scientific Instrumentation?

Prof Langhoff: In 1973 the Center for Scientific Instrumentation (WGB) was formed out of the former academy shops for research. The number of employees in that center has increased up to now by a factor of 300 percent and the amount of manufacture has increased tenfold. Moreover, the Central Institute for Nuclear Research in Rossendorf as well as the DLE in Berlin-Adlershof, Berlin-Buch, and Leipzig have been giving attention to the central tasks of the WGB.

The working methods and results of the Center for Scientific Instrumentation, as one of the largest facilities of the AdW in this domain, may be characterized as follows:

- i. optimal proportioning of the emphasis on long-term primary equipment development in the interest of flexibility and dynamics. This would have the object of providing not only products at the international scientific top-quality level, but also would meet new research needs required over the short term (optical, high-frequency spectroscopy, X-ray spectroscopy, special equipment in microelectronics, et al.);
- ii. preservation of the unity of long-term fundamental research, methodical preliminary studies, equipment development, and applications;
- iii. complex distribution of responsibilities of the R&D collectives within the framework of product complexes for instrument development, process and manufacturing technology, applications and servicing (high-frequency spectroscopy and X-ray spectroscopy, biotechnology);
- iv. complex transfer of scientific-technical knowledge into the domain of microelectronics, information processing, thorough use of microcomputer technology in all instrument developments, expansion of software output;
- v. development, design, and manufacture of modularly constructed equipment systems for multivalent applications, e.g., structural groups for ultrahigh-speed spectroscopy;

vi. participation in joint complex research projects with national and international cooperating partners. In this cooperation, to an increasing degree, structural groups, functional units, and scientific devices are developed with division of labor, manufactured, and made available to the participating partners;

vii. transfer of the center's scientific-technical results having high national economic relevance and meeting major demands into industrial mass production (crystal-growing facilities, laser technology, xy plotters, plotting technology, as well as special analytic technology).

[Question] The Center for Electronic Instrumentation at the Mittweida Engineering Advanced School is an instrument design facility having a very special profile. Prof Zscherpe, what is the center's goal and how does it fit into the overall profile of scientific instrument construction?

Prof Zscherpe: The Center for Electronic Instrumentation was founded in 1983. In founding it we preserved links with old traditions because under the name of Mittweida Technikum, founded in the year 1867, this college not only had a good reputation in the training of technicians and engineers but also as a facility for equipment and machinery construction. And also the manufacturing shops were an important basis for practical training.

In the 3 years of its existence the workers of the Center for Electronic Instrumentation have created the groundwork for manufacture of electronic primary units entering into scientific instrument construction.

Already during this period printed circuits, components of the CAMAC computer system and of the LC-85 laboratory computer system were being manufactured. Moreover, rationalizing devices have been developed and built which perfect the manufacturing of electronic equipment and there has also been developed a testing computer which has already proven its worth in testing electronic components and has substantially shortened testing time. The Center for Electronic Instrumentation will also increasingly undertake the task of assimilating important research results from other advanced schools so as to make them available to a wider circle of scientists for research and for education. And by embarking upon the manufacture of double-sided printed circuits a further step has been taken toward creating prerequisites for the manufacture of high-quality electronic components and devices. In this way the Center for Electronic Instrumentation can ever more successfully fulfill its original purpose, namely to place electronic primary components at the disposal of the universities, the advanced schools, and the medical academies of the GDR, and also at the disposal of their partners: the Academy of Sciences and the Academy of Agricultural Sciences of the GDR.

The editors of this publication thank all the professors for their clear account of tasks and achievements in scientific instrumentation. The questions were presented by Doc Dr sc techn Joachim Laemmel, chief of the Coordinating Office for Scientific Instrumentation, and Dipl-Eng Lutz Hoedtke of the Mittweida Engineering Advanced School.

LATIN AMERICA/AEROSPACE

FRENCH SPACE OFFICIAL VISITS WITH TECHNICIANS

PY200306 Paris AFP in spanish 1738 GMT 17 Jan 87

[Text] Cayenne, 17 January (AFP)--The director of the Guiana Space Center [CEG] Andre Remondiere, and local officials of the European Space Agency and the Ariane Space, have visited with Brazilian space technicians for 1 week.

The opening of the European Space Center exposition in Kuru on 10 January 1987 has given Remondiere an opportunity to express to the press his satisfaction with the productive relations with Brazil in the space research field.

Remondiere wanted to see the Natal base up close. It is the first tracking station overflowed by rockets that take off from Kuru. The functioning of the natal base is perfect, as is the preparation of our Brazilian colleagues, who are highly efficient, he stated.

The delegation that arrived from Kuru is very interested in the work of the Brazilian space technicians. According to the CEG director, the technicians have thoroughly learned everything about a space flight.

Thus, provided there are no unforeseen problems, the Brazilian technicians will be able to carry out the space program at the new test center at Sao Jose dos Campos, which is as complete as any of the French centers in Paris.

A slight delay in the manufacture of the Space Launching Vehicles [LVS] device will be compensated for between now and 1989. As far as the future Alcantara base (Maranhao state) is concerned, the call for bids for the civil engineering work has already been made.

Remondiere has taken advantage of his first trip to Brazil to revise official contracts with Brazilian officials regarding the use of Natal as the first tracking station for future launchings from Kuru.

He added that Brazil receives technical assistance from certain French organizations in the development of its satellite launching vehicle, and that other organizations are supplying Brazil with material for the construction of the Alcantara base.

Referring to the next launching from Kuru, Mondiere stated that the tests of the third stage of the rocket, which are being conducted in Paris, are in the advanced stage.

The training to operate the CEG base is conducted in Kuru. The second stage of the training, which ended in mid-December 1986 was satisfactory, and the third stage will end in mid-February 1987. Then, we will be ready to begin preparations for launching the rocket that is scheduled to put in orbit the Aussat, the Australian Telecommunications Satellite, and the ECS (European Communications Satellite), Remondiere stated.

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LATIN AMERICA/TECHNOLOGY TRANSFER

BRIEFS

SOVIET CITES INTEREST IN MICROCOMPUTERS--Viktor Isakov, Soviet ambassador to Brazil, has confirmed his country's interest in purchasing Brazilian-made microcomputers. He also said that the Soviet Union wishes to increase trade with Brazil, especially by developing a joint fishing venture. Isakov added that the other areas in which his country is interested are culture, aviation, and agriculture. [Text] [Brasilia Radio Nacional da Amazonia Network in Portuguese 0900 GMT 18 Dec 86 PY] /12858

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